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PROGRESS REPORT ON PESTICIDES AND RELATED ACTIVITIES

Research
Education
Information
Regulation
Control
Monitoring

U.S. DEPARTMENT OF AGRICULTURE AND COOPERATORS

FEBRUARY 1968

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Table 2 (Part A). FUNDS AVAILABLE FOR PESTICIDE AND RELATED ACTIVITIES
United States Department of Agriculture
Totals by Agency for Fiscal Years 1967, 1968, and 1969 Estimated
(Thousands of Dollars)

Agency	1967			1968			Estimated	
	Program	Facilities	Total	Program	Facilities	Total	1969 Total	
Agricultural Research Service	82,261	1,653	83,914*	82,698	2,762	85,460*	86,566*	
Agricultural Stabilization and Conservation Service	28	-	28	29	-	29	19	
Cooperative State Research Service	9,409	2,063	11,472	8,977	150	9,127	9,274	
Consumer and Marketing Service	535	-	535	639	-	639	732	
Economic Research Service	511	-	511	512	-	512	517	
Federal Extension Service	4,360	-	4,360	4,400	-	4,400	4,400	
Forest Service	18,184	857	19,041	16,118	477	16,595	16,333	
National Agricultural Library	333	-	333	295	-	295	295	
Office of Information	79	-	79*	58	-	58*	68*	
Research Program Development and Evaluation Staff	15	-	15*	15	-	15*	15*	
TOTAL	115,715	4,573	120,288	113,741	3,389	117,130	118,219	

* Includes resources drawn from a \$250,000 intra- and interdepartmental pesticide coordination fund first appropriated to the Department in Fiscal Year 1965

1967 PROGRESS REPORT

ON

PESTICIDES

AND

RELATED ACTIVITIES

U. S. Department of Agriculture
and Cooperators

This report has been prepared in limited numbers. Persons having a special interest in the development of public pesticide and related programs may request copies from the Research Program Development and Evaluation Staff, Room 3119 South Building, USDA, Washington, D. C. 20250.

Targets of USDA Program
Pesticides and Related Activities

- I. To gain knowledge of the taxonomy, biology, ecology, physiology, pathology, metabolism, and nutrition of pests and host plants and animals.
- II. To improve and develop means of controlling pests by nonpesticidal methods.
- III. To develop safer and more effective pesticide use patterns, formulations, and methods of application; and improved methods for detecting, measuring and eliminating or minimizing pesticide residues in plants, animals and their products, and in the environment.
- IV. To study the toxicity, pathology, and metabolism of pesticides and investigate levels, effect, and fate of their residues in plants, animals and their products, and in the environment.
- V. To study economic aspects of pest control; survey pesticide use; determine the supply and requirements for pesticides; and give assistance to control agencies and industries in emergencies.
- VI. To control pests.
- VII. To monitor the presence and distribution of pesticides in plants, animals, and their products, and in the environment.
- VIII. To administer the regulatory statute--the Federal Insecticide, Fungicide and Rodenticide Act--to assure properly labeled pesticides, with guidelines for their safe and effective use, and to prevent the marketing of harmful, adulterated or misbranded products.
- IX. To educate and inform the public about the importance of pesticides and pest control, and the need for safe and proper use of pesticides; maintain a Pesticides Information Center; coordinate and review pesticide and pesticide-related activities of the U.S. Department of Agriculture and coordinate them with other Federal, State, and private organizations.

Nature of the Report

This report summarizes and describes in a general way the pesticide and pesticide-related activities of the Department of Agriculture and its cooperators. These activities involve Research, Education, Information, Regulation, Pest Control, and Monitoring - all directed toward the development and use of safer, more effective pest control measures and the maintenance and improvement of the quality of the environment.

Examples of activities and progress for 1967 are described under nine general targets as shown on the opposite page.

Some of the kinds of information found in the report are:

1. A naturally occurring compound with strong juvenile hormone activity for one family of insects was isolated and identified from wood of the balsam fir tree.
2. Fall migration of the army cutworm is largely dependent on the movement of Pacific cold fronts.
3. Many large-seeded species of weeds do not require light for germination, while many small-seeded species respond positively to light accompanied by proper temperature manipulation.
4. Ruminal microorganisms do not metabolize the triazine herbicides, propazine, atrazine, and simazine.
5. Drug resistant coccidia may regain sensitivity to the chemicals.
6. Nonspecific antigens for swine kidneyworms were detected in tests.
7. Long-term studies of a wheat-sorghum-fallow rotation indicate that a maximum use of herbicides combined with minimum tillage causes a shift from primarily broadleaf weeds to primarily weed grasses.
8. Resistance to three herbicides was discovered in natural lines of wild oats.
9. The normal summer diapause of the alfalfa weevil was effectively terminated by topical application of a synthetic hormone.

10. Patterns of distribution of pesticides are consistent with xylem traces in plant stems.
11. There is a higher concentration of RNA in nematodes carrying fan leaf virus than in healthy specimens.
12. If part of a tomato root system is infected with the root-knot nematode, the rest of the root system becomes susceptible to the Fusarium wilt organism.
13. Thermal infrared remote sensing readings showed highly significant differences between healthy and diseased tree crowns.
14. Infection of needles by a fungus through stomata has been demonstrated.
15. Olfactory stimuli were found to influence motor responses of the Douglas-fir beetle.
16. Protozoa, bacteria, fungi, nematodes, and viruses attack mosquitoes.
17. A polypropylene wrapping on food shell cartons gave excellent protection against insect infestation.
18. Sanitary measures at a single farm resulted in marked reduction of house flies even though unsanitary farms were as close as one-half mile away.
19. A consistently high mortality of face fly eggs and larvae throughout the season in central Missouri can be attributed to parasites and predators.
20. Attempts to transfer immunity to nematodes in lambs with whole blood, serum, and gamma globulins from resistant sheep were not successful.
21. Water extracts of cereal grains or legumes may contain oviposition attractants.
22. One spring variety of barley from Iran and another from Poland are resistant to the cereal leaf beetle.
23. One virus attacks grasshopper fat bodies and another attacks muscle tissue.
24. A feeding stimulant and a deterrent have been found in varieties of sweetclover susceptible and resistant to the sweetclover weevil.
25. Resistance to southwestern cotton rust has been transferred to the agronomically desirable upland-type through interspecies hybridization.

26. In addition to fresh peaches, mangos, and cantaloupes, hot water dips for the reduction of decay during marketing have been extended to bell peppers.
27. Addition of pure cellulose to soil reduces Fusarium root-rot of beans.
28. A released parasite of the pea aphid established itself under northern Idaho climatic conditions and significant parasitism was noted.
29. Aluminum foil soil mulches on rose plants effectively prevented infestation of thrips in rose flowers.
30. Genes for a significant improvement in resistance to Fusiform rust were found in native loblolly pine.
31. Irradiation with thermal neutrons is being used in developing American elms resistant to the Dutch elm disease.
32. Wood users can arrange schedules to avoid processing of sugar maple wood during periods of heavy sporulation by a fungus causing a serious allergy in humans.
33. As an aid to obtaining clearance for chemicals for minor uses on agricultural products, a list of edible crops and plants grown in the United States has been assembled.
34. A device has been constructed and tested which is capable of generating small, uniform liquid particles for use in the study of small spray particles in complex flow fields.
35. DDT was not dechlorinated by Escherichia coli grown in skim milk containing DDT.
36. Substantial progress has been made toward developing analytical procedures for a self-sustaining portable laboratory with gas chromatography as the final step for determining pesticide residues in food and feed.
37. Very little piperonyl butoxide was lost from a mill roll of kraft paper treated with synergized pyrethrins and aged in storage for one year.
38. A promising insect resistant cotton bag has been developed.
39. The first evidence of antibody formation against insecticide derivatives has been obtained.

40. New potential compounds for insect control were tested at 29 USDA laboratories in the United States and Mexico.
41. Dimethylsulfoxide enhanced responses of plants to herbicides.
42. One fall application of several sterilant chemicals and normal cultural practices gave almost complete bindweed control with no crop injury the second year.
43. Weeds taller than crops may some day be controlled by a device that has been developed to direct a stream of herbicide spray a few inches above the crop. The device includes a large funnel like trap which returns the spray to the tank.
44. A new automatic sprayer controlled horn flies on cattle with only one milliliter of spray per animal applied twice daily.
45. Steers treated with a nematocide at the beginning of the grazing season maintained a lower parasite population, had greater weight gains, and better carcass and slaughter grades.
46. An antioxidant used in commercial animal feeds was found to inhibit the development of larvae of internal parasites in cattle.
47. Further tests with phosphine fumigation of processed cereal products in rail cars showed that highly effective results can be achieved.
48. A new herbicide appears effective for selective control of witchweed in corn at rates which several succeeding crops will tolerate.
49. DDT residues on alfalfa hay can be almost entirely removed by vapor treatment.
50. A spray program in the High Plains of Texas has practically eliminated the boll weevil and has prevented the westward migration of the pest into a presently noninfested area producing millions of bales of cotton.
51. A rotary disc sprayer for applying ultra low volume concentrates was improved.
52. The systemic uptake of two soil applied carbamate insecticides was mainly influenced by soil clay. The degradation of these chemicals was increased by higher soil organic matter contents.
53. There was a marked reduction in injury to cotton plants when certain herbicides were injected in the soil as compared with incorporation or surface application.

54. The general insecticide degradation patterns of the livers of humans and rats appear to be similar.
55. The electrical activity of rat cerebellums was affected by DDT and could be noted prior to behavioral changes induced by the pesticide.
56. Feeding dieldrin contaminated forage during the dry period of cows is not feasible.
57. Incorporation of charcoal in Wisconsin soil at 400 pounds per acre completely nullified phytotoxic effects of atrazine.
58. All portions of rice plants treated with propanil contained one or more of its metabolites.
59. Endrin is readily absorbed by roots of ten crop species and is translocated throughout shoots in small amounts.
60. Preliminary tabulations for the counties surveyed in one State indicates that almost half of the corn and sorghum acreage was treated with herbicides and nearly 50 percent of the corn acres were treated with insecticides or fungicides.
61. Control of blister rust in young white pine stands was curtailed in some areas because of little chance, economically, to bring the stands through to merchantable size. Young trees were being infected at an average rate of 3 percent per year in spite of best known control efforts.
62. The rate of returns for spraying and chaining rangeland mesquite on bottomland soils was considerably less than the return for upland.
63. In 1964 farmers used almost 458,000,000 pounds of technical materials in commercially formulated products to control crop and livestock pests. In addition, they used about 313,000,000 pounds of petroleum as a pesticide.
64. Total U.S. sales of pesticide chemicals in 1966 had a manufacturers' value of around \$800,000,000.
65. U.S. pesticide exports in 1966 were valued at \$173,633,000, up 30 percent from the previous year.
66. For pest quarantine purposes 233,194 planes; 65,143 ships; 33,783,264 motor vehicles (from Mexico); 834 coaches and pullmans (from Mexico); 56,929,668 foreign mail parcels; 208,308 shipments moving interstate; and 98,703 cargo entries under permit were examined.

67. Remote sensing including infrared and thermal sensing was tested as a detection tool for the imported fire ant.
68. Detergent chemicals used to wash pesticide residues from produce do not adversely affect keeping quality in storage subsequent to washing, providing the commodity is rinsed off once in fresh water after the detergent treatment.
69. Water soluble extracts from 50 of 59 plant species known to have anti-cancer activity gave 60 percent or greater inhibition of necrotic ringspot virus of stone fruits and 30 inhibited tobacco mosaic virus.
70. Naturally occurring extractives from many woods offer valuable clues to means for substantially improving preservative treatment.
71. Application of fungicides to control Fusiform rust on pines may be limited to a short period of maximum germinative capacity of inoculum from oak alternate hosts.
72. Death in herbicide-poisoned northern hardwoods was from vertical rather than lateral translocation of the chemical.
73. Several pesticide combinations reduced plant growth to a greater degree than expected from the effect of the individual pesticides.
74. Preliminary results suggest that movement of parathion through soils to ground water is not likely to happen regardless of soil type.
75. Two separate metabolic pathways may exist in the metabolism of lindane by house flies.
76. Amounts of adsorption of lindane by various lake sediments were related to their organic matter contents, although clay size mineral particles were also important adsorption sites. Removal of iron oxides from the minerals greatly increased their adsorptive capacity.
77. Preliminary tests with two antimetabolites indicated reduction in sperm production and inhibition of egg production in the house flies.
78. Malathion was found to be metabolized quickly by a soil fungus and bacterium. Certain colonies from one species had a marked ability to break down this compound.
79. Several organic phosphate insecticides decreased the rate of ascorbic acid oxidation and had pronounced lipid antioxidant activity.
80. When applied simultaneously, certain carbamate insecticides prevent cotton plants from degrading phenylurea herbicides.

81. Observations and evaluations of insect activity by more than 1,200 cooperators support the National insect pest survey.
82. Approximately 10 million acres were treated with mirex bait to control imported fire ant in cooperation with nine southern States.
83. In fiscal 1967 more than 6.5 billion sterile screwworm flies were dispersed over parts of the southwestern United States and Mexico.
84. In 1966, more than 1,500,000 acres of rangeland were treated with low volume malathion applied by aircraft for grasshopper control.
85. An extensive detection trapping program is operated on a continuing basis in the southern States and Mexico to detect the Mediterranean fruit fly whenever it appears.
86. Twenty-four States and the Forest Service provide surveillance for forest pest occurrences on 68 percent of the nation's commercial forest land.
87. In lieu of using pesticides, increased effort was placed on logging to control bark beetles wherever lumber markets were available.
88. Approximately 575,000 wasps parasitic to the larch casebearer were liberated in areas in the Northwest.
89. Continuing efforts to find a nonpersistant insecticide to replace DDT for spruce budworm control lead to further field tests of the carbamate, Zectran, in 1967.
90. Monitoring of soil, potatoes, peanuts and carrots in several eastern States revealed that DDT was the most widely distributed pesticide in the soil in the area studied and that it occurred in the three crops from some fields.
91. Cooperative monitoring programs, involving participation by fish and wildlife agencies, carried out on two forest insect aerial spray projects revealed no apparent adverse effects to fish, wildlife, livestock, and domestic water supplies.
92. Tissues of food-producing animals slaughtered in Federally inspected plants located throughout the United States were monitored at random for the presence of pesticide residues.
93. Violations involving lack of required precautionary labeling of pesticides and the registration number have resulted in a large number of seizures and notices of violations since October 1966.

94. A summary of Registered Agricultural Pesticide Chemical Uses is issued by the USDA. This compilation of abstracts of registered use patterns involving food, feed, and fiber crops is widely used by registrants, Federal and State Extension workers, and research agencies and food processors.
95. Many thousand packets containing information on pests and their control were made available to young people as a result of an initial distribution to members of the National Science Teachers Association and other science and biology teachers.
96. Forest insect aerial spray projects were preceded and accompanied by intensive and carefully planned efforts to inform local citizens about the insect outbreak, its seriousness, and the proposed course of action - including steps to be taken to insure safe pesticide use.
97. The first comprehensive reference guide, Safe Use of Agricultural and Household Pesticides, was distributed.
98. An average of 10,000 custom spray operators, dealers, applicators, consumers, home economics groups, and chemical company representatives attended extension training conference schools and workshops in each of several States.
99. An estimated 3-½ million viewers observed the 13-minute motion picture, Pest or Plenty?
100. Representatives of the United States, Belgium, the Netherlands, and the Federal Republic of Germany held an initial meeting to discuss regulation of pesticides and the possible impact upon consumer safety and the environment. Additional conferences were planned.

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N A T U R E O F P R O G R A M

The Department of Agriculture conducts, and otherwise supports, a comprehensive, forward looking in-depth program involving (1) pesticides and (2) related activities, the result or objective of which is pest control without using toxic chemicals or with only limited amounts of them. This report documents the general nature and objectives of this program and cites examples of specific activities and progress.

Pesticides are defined as economic poisons including (1) any substance or mixture of substances intended for preventing, destroying, repelling or mitigating any insects, rodents, nematodes, fungi, weeds, and other forms of plant or animal life or viruses, except viruses on or in living man or animals, which the Secretary of Agriculture shall declare to be a pest, and (2) any substance or mixture of substances intended for use as a plant regulator, defoliant or dessicant.

Related activities involve such things as (1) developing crop varieties and trees that are resistant to attack by specific insects or diseases, (2) controlling certain economic pests by identifying, propagating and distributing predators or parasites specifically attacking those pests, (3) introducing pests with modified biological characteristics into natural populations in order to reduce or eliminate the pest by disrupting reproduction and (4) preventing the introduction of dangerous foreign pests.

Frequently the control of a pest involves both pesticidal and nonpesticidal methods. This "integrated control" approach is an inherent part of much of the work described in this report.

Numerous components of the Department of Agriculture have major programs dealing with pesticides and related activities. These components are listed in Table 1 in the Appendix, together with indications of the general types of activities with which they are involved.

The Department was one of the original sponsors of the Federal Committee on Pest Control. It participates actively in its work, including extensive membership within its several subcommittees. In addition, USDA scientists

share in leadership and other membership participation in an Interdepartmental Weed Committee. The Department supported the establishment of Pesticide Coordinating Committees in each State. USDA employees regularly consult with these groups about policy and program matters as requested.

Close informal relationships are maintained with such industry and public organizations as the National Agricultural Chemicals Association, Manufacturing Chemists Association, Chemical Specialties Manufacturing Association, National Canners Association, National Pest Control Association, Wildlife Management Institute and the National Safety Council. These contacts include frequent exchange of information and distributional materials.

Department leaders in pesticides and related activities are working with the Food and Agriculture and the World Health Organizations of the United Nations. They also participate in the pesticide activities of the Organization for Economic and Cooperative Development, the United States-Japanese Cooperative Program sponsored by the National Science Foundation and the Codex Alimentarius Commission, which establishes international Standards for food products.

Funds appropriated to the Department of Agriculture that were allocated to pesticides and related activities for fiscal years 1967 and 1968 and those estimated for 1969 are tabulated in Table 2 in the Appendix.

Many USDA employees are directly engaged in pesticides and pesticides-related activities. This is referred to as intramural work and is coded by "(I)" at the end of paragraphs on succeeding pages in this report describing activities and progress. The Department also supports work done by other public and private agencies through contracts, grants and cooperative agreements. This extramural work is coded by "(E)". Major grant funds are also extended to State Agricultural Experiment Stations and Schools of Forestry through formula grant procedures authorized by the Hatch and McIntire-Stennis Acts. Paragraphs citing research supported in part by these funds are coded "(E-fg)".

The largest number of the paragraphs in this report describing activities and progress are accompanied by number-letter codes. Numbers refer to categories of commodities or resources and letters refer to types of pests. The scheme on which the codes are based is included in Table 3 in the Appendix.

The program of the Department of Agriculture is firmly based on research. Knowledge gained through research and action programs is applied in education, information, regulation, pest control and monitoring activities. The

pesticide and pesticide-related efforts of the Department are presented, in this report, under nine Targets shown on page ii. Examples of the kinds of work under each of the Targets are presented in the next few paragraphs.

Target I - Fundamental biology. Studies of the taxonomy, biology, ecology, physiology, pathology, metabolism and nutrition of pests and host plants and animals.

Includes such research as:

1. Understanding and manipulating diapause in insects.
2. Discovering responses of pests and hosts to light intensity, duration and wave length.
3. Prevention of fertilization of pests.
4. Maintaining standards of reference and identification of pests and their hosts.
5. Understanding relationships among competing parasites.
6. Relation of microbes to pesticide degradation.
7. Development of media for artificially rearing pests.
8. Understanding host-parasite relationships.

Target II - Improved means of nonpesticidal control. Control of pests by nonpesticidal means is an ultimate goal. Progress is being made through pest-resistant crops and trees; pest attractants and repellents; release of predators, parasites and pathogens for specific pests; and physical, cultural and mechanical control practices.

Includes such research as:

1. Utilizing germ plasm collections in breeding for disease and insect resistance and other useful characteristics.
2. Identifying and extracting naturally occurring attractants and repellents.
3. Controlling pests with parasites and predators.

4. Controlling pests through improved cultural practices.
5. Controlling animal diseases by vaccination.
6. Developing artificial atmospheres for controlling pests of stored commodities.

Target III - Improved pesticide use patterns. New knowledge about present and potential pesticides is sought to develop safer and more effective use patterns, better formulations, and more efficient application methods. Procedures are developed for detecting and measuring the pesticides and metabolites and for eliminating or minimizing residues.

Includes such research as:

1. Fumigating stored products, both in storage and in transit, with nonresidual pesticides.
2. Insectproofing of packing materials and fabrics with newer nontoxic compounds.
3. Increasing the accuracy of application of pesticides.
4. Reducing the amounts of pesticides applied.
5. Eliminating or reducing damage of pesticides to plants, animals and wildlife.
6. Finding of promising replacements for persistent pesticides.

Target IV - Toxicology, pathology, metabolism and fate of pesticides. New knowledge is sought about toxicological and pathological effects of pesticides and their metabolites--applied or fed to laboratory and farm animals, or applied to crops. Information is also developed about levels of residues and their metabolic pathways in plants, animals and their products and in the environment and ways to deal with them.

Includes such research as:

1. Determining the metabolism of pesticides.
2. Measuring the persistence and distribution of pesticides in soils.

3. Screening of pesticides for gross toxicology and pathology in animals.
4. Detoxifying pesticides.
5. Determining the storage of residues in plant and animal tissues and products.
6. Evaluating the impact of pest control on the environment.

Target V - Economies of pest control, use, supply, and requirements of pesticides. Determinations are made of the economics of pest control, of where and what pesticides are used where and of the supply and demand of pesticides.

Includes such research as:

1. Estimating nationwide use of pesticides.
2. Ascertaining the demand for pesticides, both nationally and internationally.

Target VI - Control of pests. Where necessary, local, State or Federal agencies conduct area pest control programs. In addition, steps are taken to exclude dangerous foreign pests from this country.

Includes such actions as:

1. Eradicating economic pests.
2. Detecting and treating new infestations to prevent buildups in populations of destructive pests.
3. Halting or minimizing the threat of spread of important economic pests.
4. Intercepting thousands of pests at point of entry.
5. Discovering and controlling pest species new to the United States.

Target VII - Monitoring. The presence and distribution of pesticides are systematically measured in agricultural raw materials and food and in the environment.

Includes such monitoring as:

1. Soil in selected areas of high, moderate and no pesticide usage.
2. Samples of domestic and imported meats.
3. Samples of several root crops.

Target VIII - Regulation. The Department of Agriculture is responsible, by law, for the Federal Insecticide, Fungicide and Rodenticide Act. Compliance with this Act is required to assure properly labeled pesticides with guidelines for their safe and effective use.

Includes such actions as:

1. Registering an increasing number of products.
2. Surveying products for compliance.
3. Participating in the development of interdepartmental procedures for registration.
4. Reevaluating registrations on basis of current information.

Target IX - Information, education and coordination. Results of research and facts about control efforts are transmitted through information and education activities. Constant emphasis is placed on safe and effective use of pesticides. A review of the voluminous literature on pesticides is regularly published. USDA programs are coordinated, not only within the Department but also with other Federal, State and private organizations.

Includes such actions as:

1. Producing and distributing television and radio spot announcements on using pesticides safely.
2. Developing motion pictures on the need for pesticides and their safe use.

3. Operating a computer-based information retrieval system.
4. Distributing educational materials to schools on a nationwide basis.
5. Conducting training meetings and schools on safe and effective pesticide usage.
6. Fostering and participating in intra- and interdepartmental coordination.

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E X A M P L E S O F
A C T I V I T I E S A N D P R O G R E S S

TARGET I

TO GAIN KNOWLEDGE OF THE TAXONOMY, BIOLOGY, ECOLOGY,
PHYSIOLOGY, PATHOLOGY, METABOLISM, AND NUTRITION
OF PESTS AND HOST PLANTS AND ANIMALS

General

World Literature on Physiology of Resistance of Plants to Fungal Diseases Reviewed. As a first step in beginning work on the physiology of resistance of southern pines to fusiform rust, the world literature has been reviewed. It provides a sound basis for new work and insures against repeating work done previously. This review has been published as a service to scientists in all plant fields who are concerned with disease resistance. (I) Gulfport, Mississippi. 1-A

Soil Rhizosphere Interactions. Chemical analysis of available carbon compounds in soil has been developed. With this technique approximately 0.0188 grams of dextrose can be detected in 100 grams of soil. Mathematical models and curves developed from calculations of the interaction of disease severity and inoculum density have been assembled for various assumptions. The basic mechanisms of the interaction of soil microorganisms and host plants in the rhizosphere can now be expressed in mathematical terms. (E-fg) Colorado Agr. Exp. Sta. 1-A

National Fungus Collections. Specimens now total 714,973; accessions during the year numbered 6,949, excluding an estimated 95,000 contained in herbaria acquired from Stanford University and Brooklyn Botanic Garden but not yet worked up. Specimens loaned for research study by specialists of the United States and nine foreign countries totaled 1,442; exchange specimens sent to United States and foreign institutions numbered 423 and those received totaled 1,080.

Identifications of miscellaneous fungi by staff members included 168 reported by letter and many others of local origin identified for technical workers and the general public. Some 2907 identifications of fungi intercepted at United States ports of entry were made by the mycologist assigned to this work. Fungal, bacterial, and viral names in 87 manuscripts for publication by Department workers were checked for accuracy and conformity to International Codes of Nomenclature. Nomenclatorial catalogues were increased by 2533 entries and literature catalogues by 11,036.

(I) Beltsville, Maryland.

1-B

The Mechanisms of Survival of Root Infecting Fungi in Soil. Research has continued on determining the mechanism responsible for failure of fungal spores to germinate in soil. For most fungi, soil fungistasis can be explained by a deficiency of soil nutrients required by the spores for germination. Some nutritionally independent fungi, however, fail to germinate in soil. Since spores of this type fail to germinate during leaching with slowly dripping sterile distilled water, their sensitivity to soil fungistasis is considered to be a response to the presence of a strong diffusion sink for nutrients in the soil. Although extracts of sterilized soil contain sufficient nutrients for germination of nutrient dependent spores, extracts of natural soil did not. Extracts of alfalfa amended soil, however, supported spore germination. In alfalfa amended soil, germination of nutrient dependent spores occurred only very close to the added organic matter. Therefore, the bulk of the soil apart from undecomposed organic matter remained deficient in nutrients. Unavailability of soil nutrients required for germination may explain fungistasis in most cases; for others, a strong diffusion gradient for nutrients somehow induces inactivity. (E-fg) Mich. Agr. Exp. Sta.

1-B

Germination of Teliospores of the Rust Fungus *Frommea obtusa*. Recent investigations on the common rust of creeping cinquefoil have disclosed that teliospore germination of the fungus (*Frommea obtusa*) deviates from classical behavior. Depending on the environment, the promycelium (germ tube): (1) Developed into a long-non-septate tube; (2) became septate, and broke apart into its component cells which germinated directly; or (3) behaved classically in becoming septate with component cells forming basidiospores. Teliospores dried for 3 days germinated within 3 hours; others dried for 35 days required 8 hours. Exposure to high humidity for 18 hours immediately prior to sowing the spores did not affect germination. The disarticulated component cells formed germ tubes with greater vigor than did basidiospores. The discovery of the basidiospore-bypass mechanism of *Frommea* contributes to our knowledge of life-cycles of rusts and may have practical effects in determining the ability of the fungus to survive and germinate in its natural environment. (I) Beltsville, Maryland. 1-B

Mechanisms of Survival of Root-Infecting Fungi in Soil. Mycelial and conidial forms of Helminthosporium sativum were placed in gas sterilized soil and buried outdoors during the winter months. The number of propagules of each form was substantially reduced at the end of the test period. Conidia were not produced by the overwintering fungus. Surviving mycelium remained intact and produced both chlamydospores and budding. Surviving conidia were predominantly larger, very dark, and thick walled. In studies on the nutrition of H. atrovirans, certain inorganic ammonium compounds were utilized more efficiently than nitrates as nitrogen sources. The sugars L-arabinose, D-mannose, and lactose were utilized efficiently as carbon sources. This fungus was completely deficient for biotin and partially deficient for thiamine. (E-fg) N. D. Agr. Exp. Sta. 1-B

New Fungal Naphthoquinone. The synthesis of Lambertellin, a new naphthoquinone produced by Lambertella, has proven very difficult. Recent methods starting with Isatin as the starting material have proven unsuccessful. However, several new compounds were synthesized and these findings will be published soon. It has been decided to alter the entire approach to synthesis of this compound and the lactam of Lambertellin, a-naphthol will be the starting material. (E-fg) Vt. Agr. Exp. Sta. 1-B

Research on Antibiotics and Fungus Physiology. Studies were continued on Flavensomycin, an antibiotic which prevents the growth of a wide range of fungi. Penicillium oxalicum was the most sensitive of the many species studied. The antibiotic inhibited the oxidation of a wide variety of carbohydrates, amino acids and succinic acid. Effects on various enzyme systems of P. oxalicum indicate that the terminal electron transport system very closely resembles that of mammalian species. Other studies are in progress to determine concentrations of the enzymes and other auxiliary factors in cells of various ages. It was also shown that protein synthesis is reduced with increased age. The sterol content of fungus spores appears to change with age. Certain fungi were grown on semisolid culture so that mycelium could be separated into sections bearing cells of various ages. It was found that the ergosterol content of both fungi studied gradually decreased with age until no sterol was discernible by gas chromatography. (E-fg) Ill. Agr. Exp. Sta. 1-B

New Fungi Discovered on Selaginella. A comprehensive study of the fungi that occur on the small club mosses (Selaginella) has resulted in the important discovery of 2 new genera and 16 new species of fungi. The new fungi are members of the Ascomycetes and Fungi Imperfecti and are closely related to species that cause cankers, blights, and leaf spots of crop plants. The new genera have been named Crucellisporium and Phaeodochium. Descriptions and illustrations of all of the new fungi will

soon be published as a part of an extensive treatise summarizing published information and observations based on the critical examination of more than 100 herbarium collections of 27 species of *Selaginella*. (I) Beltsville, Maryland. 1-B

Soil-Inhabiting Truffle Fungi. Research on the cytology of *Stephensia shanori* has shown that the ascocarp develops angiocarpically (closed until spores are mature), that sacci arise from binucleate cells without crozier formation, that meiosis and a mitotic division occur after karyogamy and precocious synapsis, and that the mature ascus contains eight nuclei and eight or fewer spores with a haploid chromosome number of 25. (I) Beltsville, Maryland. 1-B

Imperfect Fungi and Discomycetes. Extremely involved problems of the nomenclature of the genus *Stilbella* and the family Stilbellaceae have been resolved in a manuscript proposing conservation of the genus and providing a Latin diagnosis and typification for the family. Research has been initiated recently on the biology and taxonomy of imperfect stages of the Sclerotiniaceae, beginning with the highly parasitic genus *Monilinia*. Other research has been initiated on the discomycete genera *Helvelia* and *Discina* toward the goal of monographing these genera. (I) Beltsville, Maryland. 1-B

Chemical Mutagenesis of Tobacco Mosaic Virus. Tobacco mosaic virus (TMV) is a useful organism for the study of the relationship between structure and function. When TMV and its isolated ribonucleic acid (TMV-RNA) are treated with nitrous acid under similar conditions, TMV-RNA is inactivated 5-6 times faster than TMV. Mutants induced after nitrous acid treatment were scored for three biological properties (symptoms on Samsun tobacco, lesion size on Xanthi-nc, and reaction on Java tobacco) after 50, 10, 1.0 and 0.1 percent levels of survival. The total number of mutants developing when intact TMV is treated with nitrous acid is appreciably greater than when isolated TMV-RNA is so treated. The nitrous acid induced mutant of TMV induces strikingly different symptoms on susceptible plants and is poorly transported in systemic host plants in contrast to the wild type TMV. Preliminary studies indicate no alterations in the serological properties of this mutant. (E-fg) Mo. Agr. Exp. Sta. 1-B

Wood-Inhabiting Forest Fungi. Comprehensive study of the microscopic morphology and anatomy of fruit bodies and cultures of members of the fungus genus *Vararia* elucidated many structural details that show the relationships between growth in culture and in the fruiting bodies formed under natural environmental conditions. These results constitute the most thorough characterization ever published for this genus. Study of imperfect

fungi associated with the project has resulted in the discovery of new species of Betryobasidium, Tharoopama, and Harpoglyphium, elaboration of description of others, and the clarification of the nomenclatural status of the generic names Dactylaria and Dactylium. (I) Beltsville, Maryland.
1-B

Equilibrium Humidities of Arthropods of Agricultural Importance. A survey of 22 species of insects and mites of agricultural importance has shown that net uptake of water vapor from the atmosphere seems to occur particularly among arthropods known as stored product and household pests. It was shown that species of Liposcelis absorb water vapor from the atmosphere, down to relative humidity of approximately 55%, the critical equilibrium humidity. Above this level they maintain their equilibrium water content for weeks and increases in population can take place. Below the critical equilibrium humidity water loss is more or less drastic depending on the species, and death occurs sooner or later. The organism can tolerate a loss up to 70% of its water. (E-fg) Ohio Agr. Exp. Sta. 1-C

Circadian Rhythm of Sensitivity of Insects to Insecticide. Separate groups of comparable house flies and cockroaches were exposed each hour around the clock to a constant dosage of a pyrethrum aerosol. Highest kills of both flies and roaches were obtained at 4:00 p.m. (I) Beltsville, Maryland.
1-C

Diapause Termination in several adult insects including the alfalfa weevil and the cereal leaf beetle, has been effected in the laboratory by topical treatment with the potent synthetic juvenile-gonadotropic hormone 10,11-epoxyfarnesenic acid methyl ester. Previously diapausing beetles began feeding, mating, and reproducing within approximately a week after treatment. (I) Beltsville, Maryland.
1-C

Carbonic Anhydrase Enzyme in Insects. The presence of carbonic anhydrase has been verified in three diverse orders of insects represented by the house cricket, the honey bee, and the black carpet beetle. Several hypotheses have been investigated to explain the role of this enzyme in insect respiration. A new technique for analysis of carbonic anhydrase using a natural substrate has been developed and verified by conventional methods. New instrumentation is under development to allow direct measurement of CO₂ in the blood of the larger species and to allow a closer study of the discontinuous respiratory process in insect. (E-fg) N. Y. C. Agr. Exp. Sta.
1-C

Humidity and Insect Behavior. The saw-toothed grain beetle has demonstrated its ability to perceive and respond to different levels of relative humidity. Adults that had been reared at 30° C. and 80% RH were offered a choice between 92% and 10% RH and showed a preference for the drier condition. Adults that were desiccated and starved for 24 hours showed much less preference for the dry condition and such treatment for 48 hours caused a complete reversal of behavior. Similar reactions to humidity have been demonstrated in other stored-product insects that normally inhabit relatively dry environments and are resistant to desiccation. (I) Savannah, Georgia. 1-C

Insect Hormones. A naturally occurring compound with strong juvenile hormone activity for insects in the family Pyrrhocoridae was isolated and identified from wood of the balsam fir tree (Abies balsamea) and named juvabione. This compound readily penetrates the insect cuticle, interferes with development and blocks metamorphosis. The family Pyrrhocoridae contains several pest species such as the cotton stainers. The high biological activity and specificity of this compound indicates the possibility of tailoring compounds to affect only insect pests without harming beneficial insects. (I) Beltsville, Maryland. 1-C

Molting Hormones. Three different ecdysones have now been isolated and identified from tobacco hornworm pupae and their structure and biological activity suggests these hormones (α -ecdysone, 20-hydroxyecdysone, and 20,26-dihydroxyecdysone) to be intermediates in a biosynthetic scheme. However, each hormone could have a specific function with the 20,26-dihydroxyecdysone perhaps being involved in the pupal to adult molt. Further work is underway to determine the specific roles of these potent biological regulators and how they can be used to disrupt insect growth and development. (I) Beltsville, Maryland. 1-C

Standardization of Microbial Insecticides. Mode of action studies of a toxin from Bacillus thuringiensis commercial pesticides show the toxic parasporal crystals adversely affect proteins in the insect cell membrane as well as to denature protein enzymes involved in cellular processes such as glycolysis, oxidative respiration and the Krebs's cycle, causing instant disruption of the cell. This information is being used to select more toxic strains and to develop more accurate standardization of commercial products. (I) Beltsville, Maryland. 1-C

Photoperiod Studies. Darkness or very low light intensity enhance mating activity of Indian-meal moths. In darkness, over 90% of females were mated within 24 hours after emergence while under constant light only 50% were mated in the same time. Preliminary observations also show that

darkness enhances oviposition and that constant light delays oviposition at least for the first 24 hours after emergence. Under alternating light and dark cycles all oviposition was during the dark period. (I) Savannah, Georgia. 1-C

Effects of Weather on the Activity and Population Level of Insects. A computer program is being written for the method of population determination by means of independent variables of the environment. Experimental verification of the method was obtained. This experiment was a laboratory analogue of a field situation in which an actual population of 500 insects was estimated at 501.4 and a population of 50 insects at 59.7 with limits respectively of ± 15 and ± 19 . (E-fg) S. C. Agr. Exp. Sta. 1-C

Migration of Aphids and Noctuids. Insect samples were taken by airplane at 2,000 feet with fine nylon mesh nets attached to the wing struts. Diurnal and nocturnal samples were taken at weekly intervals in an East-West direction to sample South to North low level jet streams. All specimens were stored in 95% ethyl alcohol for later identification. Seventy-two aphids were collected (55 during day flights and 17 at night) and identified as 34 corn leaf aphids (Rhopalosiphum maidis), 9 English grain aphids (Macrosiphum avenae), 8 greenbugs (Schizaphis graminum), 6 Lachnid, 5 Callaphid, 3 apple grain aphids (Rhopalosiphum fitchii-padi), 3 Eriosomatid, 1 Macrosiphum sp., 1 Aphis sp., and 2 unidentified aphids. (E-fg) Kans. Agr. Exp. Sta. 1-C

Corn Earworm Nutrition. Pupae of the corn earworm developing from larvae reared on soybeans were significantly lighter (330 mg) than those developing on corn (473 mg). The rate of gain was also greater on corn. (I) Columbia, Missouri. 1-C

Fall Armywork Sex Pheromone Identified and Synthesized. This sex pheromone has been identified as cis-9-tetradecen-1-ol acetate. Two procedures for synthesizing this compound have been developed, one of which should be adaptable to commercial production. (I) Beltsville, Maryland and Tifton, Georgia. 1-C

Analogues of Propylure Attract Fall Armyworm. Two synthetic analogues of propylure, the pink bollworm sex attractant (cis-5, cis-9- and trans-5, cis-9-tridecadienyl acetate) have been found sexually attractive to male fall armyworm moths. (I) Beltsville, Maryland. 1-C

Cost of Mass Rearing Fruit Flies Reduced. Conversion from dehydrated carrot powder larval diet to a low-cost diet, consisting of middlings, shorts, sucrose, Torula yeast, Gelgard M, sodium benzoate, Nipagen, HCl,

and water, was made in the laboratory for the production of the melon fly, Medfly, and oriental fruit fly. Nearly 39 million pupae were produced from approximately 60 million eggs. Six liters of the new diet will support 125,000 Mediterranean fruit fly larvae. The middling-shorts diet produces a slightly smaller melon fly pupae than the carrot diet. Material cost for the production of the Medfly is approximately \$10.00 per million pupae and for oriental and melon flies about \$16.00. (I) Honolulu, Hawaii. 1-C

Gall Midges on Compositae. The gall-midge genus Asteromyia contains rather large individuals that make bright-colored galls on plants belonging to the composite tribe Astereae. Although these midges are not of primary economic importance, they are of interest to the taxonomist because of their host relationships. A recent revision of the genus shows that the 33 previously described forms actually belong to only about 12 species, based on their host preferences and an exhaustive study of their morphology. The sections of the revision on morphology and systematic relationships of Asteromyia form a basis on which other genera of this taxonomically difficult tribe can be revised. (I) Washington, D. C. 1-C

Prevention of Egg Development in House Flies. Female house flies are ready to lay eggs when 4 days old. They are stimulated to oviposit by moist, decomposing, organic material in which the larvae will grow. If a female finds such a medium, she will lay about 100 eggs, and a second batch of eggs of similar size will immediately start developing to be laid a few days later. However, if the female does not oviposit, the second batch of eggs does not develop. It was found that the ovaries with mature eggs produce a chemical which inhibits egg growth. This substance can be extracted in alcohol and prevents development of eggs when injected into young females. (I) Fargo, North Dakota. 1-C

Prevention of Mating in House Flies. Female house flies mate only once because they react to a chemical in the semen of the male. This substance is produced by glands in the male copulatory duct and can be extracted with alcohol from excised ducts or from ground-up flies. This substance is insoluble in most organic solvents and soluble in water. Virgin females injected with a water solution of the substance react like mated flies and reject males. A similar substance has been extracted from screw-worm flies and black blow flies and prevents mating when injected into virgin house flies. Work is continuing on the isolation and identification of the chemical. (I) Fargo, North Dakota. 1-C

Diapause in Flies. Diapause studies indicate that this phenomenon is induced by an interaction of temperature and photoperiod length. The exact nature of this interaction is being studied. An 8 hour photophase at 60° F.

induces diapause. An 8 hour photophase at 80° F. induces ovarian development. A 16 hour photophase at 40° F. induces an automatic condition in most flies, but this appears to be lack of development rather than diapause. The stimulus to diapause is received by the adult fly. An exposure to diapause inducing conditions of approximately 10 days is necessary for maximum diapause. (E-fg) Kans. Agr. Exp. Sta. 1-C

Bionomics of the Indian-Meal Moth. Late-instar larvae of the Indian-meal moth gave a negative phototactic response to white light. A parasitic wasp, Bracon labetor, a predatory mite, Melichares tarsalis, and two symbionts were discovered in the colonies of insects, and may be considered later in relation to their influence on populations. (E) Clemson University. 1-C

Mitochondrial Metabolism in the Indian-Meal Moth. A technique for isolating mitochondria from larvae of the Indian-meal moth and a reliable procedure for studying their oxidative activities have been developed. The oxidation rates and respiratory control indices for a variety of substances are being determined for mitochondria isolated from larvae at different stages of development. Data thus far indicate a general decline in mitochondria activity in the late stages of larval development. This is accompanied by a decrease in mitochondrial nitrogen per unit weight of tissue. (I) Savannah, Georgia. 1-C

Khapra Beetle Studies. A highly productive 5-year project has developed extensive basic information about the khapra beetle. The work was done in Israel because cultures of this quarantined insect cannot be maintained in the U.S. Sixteen manuscripts originated from this project and most are already published. Examples of kinds of information developed are: (1) Factors that induce diapause, (2) a pheromone functioning as a congregating substance is produced by adult males and females, attracts adults of both sexes, and repels adult red flour beetles, (3) photic and moisture responses of adults and larvae, and (4) relationships between the insects and microflora. (P.L. 480) Hebrew University, Jerusalem, Israel. 1-C

Diapause in the Khapra Beetle. Studies in India showed that khapra beetle larvae survived at 68° F., but there was hardly any growth. At 86° F. some larvae enter a quiescent stage or diapause but this did not occur at 95° and 98.6° F. Diapausing larvae showed a considerable increase in fat and glycogen content over that in normal larvae. The materials are stored as energy sources for diapause. During transformation from pupa to adult, changes in these metabolites showed a reversal of what happens during the initiation of diapause. (P.L. 480) Univ. of Baroda, India. 1-C

Taxonomic Revisions of Leafhoppers. A key for the identification of 15 species of the leafhopper genus Graminella known to occur in the United States has been prepared. G. nigrifrons, a vector of corn stunt disease, is found in all major corn-growing areas of this country. Species of the leafhopper genus Lonatura are primarily grass feeders and undoubtedly play an economic role in pasture and rangeland areas. A taxonomic revision has clarified the names of the members of this group and makes possible up-to-date identifications of the various species. (I) Washington, D. C. 1-C

Sugars Increase Survival of Lygus Nymphs on Alfalfa. Melezitose (the main trisaccharide in honeydew), sucrose, and honey markedly increased survival of lygus bug nymphs confined on alfalfa plants not in bloom. Field plots sprayed with 17-percent sucrose and honey solutions were highly attractive to adults. Preliminary results on cotton were similar. (I) Tucson, Arizona. 1-C

Biology, Ecology and Economics of Noctuidae in Nebraska. Analysis of weather records indicate that fall migration of the army cutworm, Chorizagrotis auxiliaris, is largely dependent upon movement of pacific cold fronts. Primary migration direct from the Rocky Mountains to the Plains coincides with frontal movement and can result in infestations in eastern Nebraska. After fall-out, secondary eastward migrations can occur. Since oviposition occurs while secondary migrations are in progress, these moths rarely contribute more than a few eggs at the eastern terminus. Light trap catches have been evaluated by considering both the population represented and the reproductive potential of that population. These results are pertinent to the geographical distribution of economic infestations. (E-fg) Nebr. Agr. Exp. Sta. 1-C

Unisexual Strain Found in the Salt-Marsh Caterpillar. A field-collected egg mass produced 105 females and no males. When females from this culture were mated with males from a bisexual culture, a total of 422 females and only 2 males were produced during 3 generations. By contrast, a laboratory maintained bisexual culture yielded 242 females and 218 males in the same period. The egg hatch for each culture was less than 50 percent. Hatch of eggs from some females of the bisexual strain exceeded 50 percent, but this never occurred in the unisexual strain. Unmated females from the unisexual strain laid infertile eggs. This tends to rule out gynogenesis as a cause of the biased sex ratio. Virgin females from both cultures were found to be attractive to males when tested in the field. (I) Baton Rouge, Louisiana. 1-C

Low Temperature Adaptation in Stored-Product Insects. Striking effects of thermal acclimation at high, medium, and low temperatures on the dispersion of insects in stored products were demonstrated in tests with adults of the cadelle, confused flour beetle, and Trogoderma inclusum. The effects have also been studied with several larval stages of the cadelle and the confused flour beetle. Curves relating time and the temperature that induces chill coma have been developed for adults of the confused flour beetle, rice weevil, and Trogoderma inclusum when acclimated at 20°, 25°, and 30° C. (E) Iowa State University. 1-C

Hypopus Stage of Mites. Hypopus formation seems more related to population density and kind of food than to temperature or humidity. Appearance of hypopi is more common in some populations than in others of the same species. Humidity affects the transformation of hypopi to tritonymphs. Histological and anatomical studies of hypopi of Acarus farris show this is not a regressive stage. It is anatomically and functionally adapted to survive unfavorable conditions and to disseminate the species. It has a thick cuticle to resist drying out and has a special complex of muscles for the sucking disc and dorsal side of the body, enabling it to attach to other animals or moving objects. There is a striking difference in the alimentary canal, where the pharynx, esophagus, and stomach are small. The walls of the stomach resemble those of the esophagus, side protuberances are small, and anterior glands are absent. (P.L. 480) Warsaw Agr. Univ., Poland. 1-C

Ecology of Stored-Product Mites. A comparison of the digestive enzymes, development, and egg laying of four species of mites has helped to explain their food requirements. Acarus siro fed and developed on the hyphae of many species of molds but fecundity was usually low. It digested starch very poorly and was adapted to foods rich in fats. This was reflected by low amylase and high lipase recoveries from the mites. A. farris digested starch and fat only in small amounts but fed much better on micro-organisms as a single food. Tyrophagus putrescentiae readily fed on all micro-organisms tested, with high fecundity and low mortality. It also digested starch rather well. Rhizoglyphus echinopus fed on many micro-organisms but fecundity was low and it digested neither starch nor fat very well. (P.L. 480) Warsaw Agr. Univ., Poland. 1-C

Insect Symbiotes and Their Involvement in Metabolism. Work has been directed principally toward elucidating the nature of insect symbiotes and their involvement in metabolism. We worked on identifying the free amino acids of the blood of Periplaneta americana, comparing specimens devoid of bacteroids (symbiotes) with normal ones. There is literature implicating synthesis of the sulfur-amino acids by the bacteroids in Blattella germanica,

but no evidence for this was obtained in Periplaneta by the method we used. At present, modifications are being made to more clearly delineate the sulfur-amino acids. We found no difference in the identifiable amino acids of the blood of normal and aposymbiotic cockroaches. (E-fg) Minn. Agr. Exp. Sta. 1-C

Tobacco Budworm Sex Attractant Isolated. The sex attractant produced by virgin female tobacco budworm moths has been isolated in pure form. (E) Univ. of Wisc. 1-C

Bionomics of Trogoderma. Collections of Trogoderma from several locations in California are yielding information on species distribution and relative abundance under different environmental and climatic conditions. Life history studies in the laboratory at different temperatures and humidities are in progress with 7 species of Trogoderma. Tests on the influence of temperature and humidity on viability and duration of the egg stage have been completed for 4 species. Matings of T. parabile are being made from parent stock collected in different areas and stock from the same area but in different years, to study the genetic plasticity of the species. A total of 2,930 specimens from 409 samples collected at 157 locations has been examined for the presence of disease organisms. A species of Mattesia was present in 92% of the 409 samples, a gregarine in 25%, and Adelina sp. in 4%. (E) Univ. of Calif. 1-C

Taxonomy of Trogoderma. Adult females of some species of the dermestid genus Trogoderma are extremely difficult to identify. To discover new identification characters, 7 species were cultured and specimens of 9 others were obtained for study. The significant discovery of an external character to identify female khapra beetles was published. It was also found that the shape and size of internal structures of the female reproductive system permit identification of other species. Drawings are being made and this information will be published after further study. A series of color photographs has been made to show the elytral color patterns of the various species. (E) Calif. Dept. Agr. 1-C

Atrazine Alters Circadian Rhythm in Plants. Transpiration rates in intact plants exhibited a circadian rhythm under apparently constant environmental conditions. This rhythm was modified by pre-conditioning of the plant prior to study and was accentuated by atrazine treatments. (E-fg) Wisc. Agr. Exp. Sta. 1-D

Bactericidal Effect of 2,4-D. 2,4-Dichlorophenoxyacetic acid (2,4-D) has a delayed bactericidal effect on growing cultures of bacteria at concentrations lower than those required to inhibit growth completely. At low concentrations

of 2,4-D the culture grows well with a high degree of correlation between total counts and viable counts. With the onset of the stationary phase of growth in the presence of 2,4-D rapid cellular death ensues during which 90% of the cells die. This delayed bactericidal effect of 2,4-D represents a new action of herbicides on bacteria and it may be a very important observation. During growth in the presence of 2,4-D cells remain extremely large whereas normal cells become smaller during the logarithmic growth phase. (E-fg) La. Agr. Exp. Sta. 1-D

Canada Thistle. Ten different ecotypes of Canada thistle varied considerably in the amount and kinds of materials (hydrocarbons, wax steral esters, wax acelates, fatty acids, and alcohols) present on leaf surfaces. The amounts of ether soluble materials ranged from 2.75 mg/cm² down to 0.985 mg/cm². The ecotypes also varied considerably in the ratio of epidermal cells to stomata. These ratio differences were consistent for the ecotypes grown under three different altitude and rainfall environments in Montana and Idaho and probably contribute to the demonstrated differential response of the ecotypes to herbicides. (I) Bozeman, Montana. 1-D

Effect of Light on Germination of Weed Seed. Research indicates that many large-seeded species of weeds do not require light for germination while many small-seeded species respond positively to light accompanied by proper temperature manipulation. Physiologically old seed responded differently from fresh seed with regard to their requirements for temperature and light. In North Carolina, a high concentration of the germination stimulant overcame the inhibitory effect of light on germination of witchweed seed. (I) Beltsville, Maryland. 1-D

Light Quality Influence Seed Development in Different Weed Species. Green and blue light caused largest numbers of seed heads to form, while yellow light caused the longest time to flower and lowest of all in numbers and weight of seed heads. Somewhat similar responses to light were found with barnyard grass plants, except that yields for yellow light were close to that of red for this species. Blue light caused smallest plants of all in both kinds of weeds. (E-fg) N. H. Agr. Exp. Sta. 1-D

Electron Microscopy of Capsella Embryos. Examination of embryos ranging from torpedo through the mature seed showed the development of aleurone grains and a dramatic increase in sperosomes marked the progress of maturation of the embryo of shepherd's purse (Capsella bursa-pastoris) similar to maturation of the peanut embryo. The aleurone proteins appeared to be synthesized on the polysomes attached to the granular endoplasmic reticulum and transported into the lumen of the cisterna and from there to the Golgi apparatus where they are concentrated to form membrane bound

protein granules. Antigenic and biochemical research is underway to identify specific proteins involved in dormancy of the embryo and other dormant plant organs that contain aleurone grains. (E) Texas A&M Univ.
1-D

Manganese and Zinc Uptake Reduced by Prometryne. Manganese uptake was significantly reduced by prometryne where no phosphorus was applied. Phosphorus negated this effect of prometryne. Zinc uptake was similarly restricted by prometryne with no phosphorus but, the results were not significant. There were no significant differences among yields and prometryne, per se, did not appear to affect the plants. These data provide justification for research concerned with herbicide-metallic ion interactions. (E-fg) S. C. Agr. Exp. Sta.
1-D

Foliar Absorption of Herbicide on Mesquite Depends on Kind of Herbicide and Degree of Moisture Stress. Gas chromatographic and thermoelectric methods were combined in a study of absorption and movement of picloram and 2, 4, 5-T in mesquite, winged elm and bean plants in various stages of moisture stress. Foliar absorption of picloram was unaffected by moisture stress in bean and winged elm, but moisture stress reduced uptake of picloram in mesquite. Moisture stress reduced herbicidal movement in all species. Stress sufficient to slow growth markedly reduced transport of both herbicides into untreated tissues. (E-fg) Texas Agr. Exp. Sta.
1-D

Inactivity of Trifluralin Attributed to Low Soil Moisture. Field results, bio-assays, and chemical analyses, show that the compound can be present in soils at levels which are normally considered herbicidal but failure from a weed control standpoint often occurs. Results of the 1966 tests indicate that low soil moisture may be the cause of this inactivity or failure to control weeds. In the past the lack of activity has been ascribed to short longevity in the soil. This now seems to be an erroneous conclusion. (E-fg) N. Y. Cornell Agr. Exp. Sta.
1-D

Water Requirements of Weeds Vary Widely. The water requirement of various weeds was determined under field conditions and varied from about 330 to 1900 (pounds of water used to produce a pound of dry matter). Buffalobur was the least efficient, and kochia, Russian thistle and puncturevine produced the most pounds of dry matter per unit of water used. (E-fg) Texas Agr. Exp. Sta.
1-D

Dormancy in Wild Oat Seed Found to be Regulated by Two Mechanisms. A 50-60% increase in germination occurred when the hull was removed from dormant seed. Yet, embryos isolated from either dormant or non-dormant

seed grew at least 8 mm when plated on agar or filter paper. To sustain growth, additional components (vitamins, amino acids, mineral salts and carbohydrates) had to be added. These data suggest two dormancy regulating mechanisms; one found in the caryopsis, the other in the hull. Aqueous extracts prepared from macerated wild oat hulls had little effect on the growth of embryos isolated from non-dormant seed. Kinetic studies have been determined for maltase, for it has been suggested to be the limiting enzyme which prevents or allows germination. Maltase was found in the embryo of dormant, semi-dormant and non-dormant seed but not in the endosperm. The activity in embryos of dormant seed was one-half that of the activity in embryos of semi-dormant or non-dormant seed. (E-fg)
N. Dak. Agr. Exp. Sta. 1-D

Nematode Systematics and Morphology. Studies are continuing in redefining and describing various genera of plant parasitic and non-parasitic nematodes. 5,545 specimens were added to the Davis nematode collection. The collection now contains 47,282 specimens representing 287 genera, with 1,682 species. The type collection contains 236 species in 61 genera for a total of 1,345 specimens. Further studies have resulted in the revision of the genus Helicotylenchus, revision of the Atylenchidae, and a revision of the Hirschmanniella, based on type specimens and a number of proposed new species. (E-fg) Calif. Agr. Exp. Sta.; Davis and Riverside. 1-F

The United States Department of Agriculture Nematode Collection at Beltsville. A total of 328 samples were processed in 1966; 233 of these were received from various agencies in 29 States, and the remaining came from 27 foreign countries. The permanent collection now contains a total of 1,551 catalogued species, including 188 type species. (I) Beltsville, Maryland. 1-F

Nematode Taxonomy and Identification. At least six new species of nematodes were received and identified: a Criconemoides and a Helicotylenchus from Florida, a Pratylenchus from Alabama, a Heterotylenchus from New Jersey, and a Pratylenchus from Ethiopia. A new superfamily and family was established in the Order Dorylaimida by describing the remarkable dorylaim nematode Encholaimus taurus, new genus and species from soil around coconut in Trinidad. Further studies and identification of the previously described pseudo root-knot nematode, Hypsoperine graminis, confirms it is a serious pest of turf from Maryland to Florida and westward to California. A major taxonomic revision of the insect parasitic nematode family Sphaerulariidae was completed after a seven-year study. The family now includes 21 genera and 116 species. Two races or biotypes of burrowing nematodes (Radopholus similis) occur in Florida. One attacks citrus and the other attacks banana, but neither resemble the original

description of Radopholus similis from banana in the Fiji Islands. Mathematical studies of populations of Belonolaimus spp. and other nematodes show that 95 percent tolerance ellipses and regression coefficients of several bivariant characters can be used in showing relationships between several populations of the same species. (I) Beltsville, Maryland. 1-F

The Interrelation of Nematodes and Other Pathogens. A unique system of microplots has been established in which various species of nematodes and other soil-borne pathogens are maintained to determine survivability and pathogenicity to various plant species grown therein. These field microplots have permitted the evaluation of survival of various forms and stages in the cycle of plant parasitic nematodes. (E-fg) Hawaii Agr. Exp. Sta. 1-F

Factors Influencing Survival and Pathogenicity of Plant Parasitic Nematodes. The soybean cyst nematode (SCN) survived in soil in the field or under controlled environment for over six years in the absence of a host plant. In field studies, resistant lines of soybeans were as effective as non-host crops and fallow in reducing the population. Techniques were developed to study Xiphinema americana under greenhouse conditions. Populations developed best on strawberry and alfalfa, and to a lesser degree on sudan grass, pine and oak. A new species of the nematode Heterodera reproduced only on members of the birch family and significant populations developed only on species of birch. (E-fg) Ark. Agr. Exp. Sta. 1-F

Physiology and Biochemistry of Nematode and Nematode-Host Relationships. Qualitative and quantitative analyses of the fatty acids of five species of plant parasitic nematodes and two host tissues have been completed. The major fatty acid fraction in all nematodes was 18:1. Research on the location of double bonds indicated that in Ditylenchus triiformis, this fatty acid fraction was 75% 18:1 (11) and 25% 18:1 (9), whereas in D. dipsaci it was 92% 18:1 (11) and 8% 18:1 (9). This was also a major fatty acid fraction in host tissues such as Pyrenochaeta terrestris and alfalfa callus tissue, but it consisted of 96% 18:1 (9) and 3% 18:1 (11) in both hosts. Several 20-carbon unsaturated fatty acids occurred in all nematodes, but were absent in host tissues. Although four of the nematode species raised on alfalfa callus tissue contained the same fatty acids, the proportions of the different fatty acids varied among nematode species. (E-fg) Md. Agr. Exp. Sta. 1-F

Effects of Chemicals on Fungi and Bacteria. Ethylene thiuram monosulfide and ethylene thiuram disulfide, oxidation products of the widely used fungicide maban, were biologically active and inhibited germination of Collato-trichum lagenarium conidia at 2ppm and 40ppm, respectively. Chromatographic

analysis of conidia that were inhibited from germinating by the above oxidation products showed that neither fungicide was present in protoplasm. However, comparison of dilutions of the fungicides in water or in protoplasmic extracts resulted in a reduction in the detectability of the compounds by the fluorescein mercuric acetate indicator technique. Ethylene thiuram monosulfide has a high fungitoxicity compared to the disulfide, emphasizing the probable role of the former in the wide spectrum of antifungal activity of the dithiocarbamates. (E-fg) Del. Agr. Exp. Sta. 1-B

Animals

Microbiological Degradation of Herbicides. Continuous culture studies demonstrated that mixed ruminal bacterial suspensions and characterized pure cultures degrade trifluralin. Extensive studies have demonstrated that ruminal microorganisms do not metabolize the triazine herbicides, propazine, atrazine and simazine. Rumen bacterial and protozoal populations in sheep were not affected by feeding propazine at weekly levels of 0, 5, 10, 20 and 40 mg/kg body weight per day. The ruminants' body tissues appear to metabolically handle propazine unaltered by ruminal microorganisms. (I) Fargo, North Dakota. 21-A

Metabolic Fate of Triazine Herbicides. Ion-exchange chromatography has demonstrated the quantitative similarity of the metabolism of the triazines-- propazine, atrazine and simazine. Simazine yields 17 urinary metabolites which co-chromatograph with 17 of 19 metabolites found with atrazine. The two additional atrazine metabolites co-chromatograph with 2 of the 22 metabolites found with propazine. There are approximately five minor propazine metabolites not found with either simazine or atrazine. (I) Fargo, North Dakota. 21-A

Biology and Control of Arthropod Pests of Livestock and Domestic Animals. Major research included dispersal and overwintering studies on the cattle horn fly Haematobia irritans, control of the house fly Musca domestica under caged poultry, and effects of chemosterilants on the northern fowl mite Ornithonyssus sylviarum. Cattle horn flies were found to travel at least 0.4 of a mile in a 24-hour period. Regression curves were established to predict dispersal over a distance of 500 yards. Highly significant differences of dispersal occurred between night and day with movement principally at night. Cattle fecal samples have been caged to determine when emergence ceases in the fall and when emergence occurs in the spring. Respiration and fat studies are now being conducted to ascertain the mode of overwintering. They apparently overwinter in North Mississippi in a pupal diapause. (E-fg) Miss. Agr. Exp. Sta. 21-C

Boophilus Tick Hybrids Show High Degree of Sexual Sterility. Cross-mated Boophilus annulatus and B. microplus ticks produced fertile eggs; however, most of the ticks, and particularly the male ticks, developing from these eggs were sterile. (I) Kerrville, Texas. 21-C

Improved Artificial Medium for Horn Flies. Application of the sterile male release technique for horn flies is contingent upon efficient mass-rearing. A medium of ground sugarcane pulp, fish meal, whole wheat flour, and sodium bicarbonate produced horn fly pupae, equal to or exceeding the size of those produced in cow manure. (I) Kerrville, Texas. 21-C

Horse Fly and Deer Fly Biology Studied. Both sexes of a deer fly but only males of a horse fly remained close to flowing creeks whereas females of the horse fly were collected on horses 3 miles away in a small scale release experiment with marked flies. Mating occurred between 7:30 and 11:00 a.m. at temperatures between 75 and 88° F. Males were active only during this period. (E) Laramie, Wyoming. 21-C

Mineral Supplement Prevents Larkspur Poisoning. Experimentally feeding cattle a mineral supplement consisting of salt, phosphorus, potassium chloride, cobalt sulfate, and flowers of sulphur on controlled range areas has prevented losses from larkspur poisoning and losses which livestockmen have stated were due to herbicidal sprayed range plants. (I) Logan, Utah. 21-D

Cytochemistry of Coccidia. Using cytochemical methods to determine the presence and distribution of certain metabolic enzymes, investigations of the basic physiology of coccidia have been conducted on Eimeria stiedae, the cause of coccidiosis of the liver in rabbits. These investigations, still in progress, have shown that the occurrence and distribution of these enzymes vary somewhat from one stage of the parasite to another. Certain of the results were unexpected and may lead to some new concepts of the physiology of these organisms. (I) Auburn, Alabama. 21-E

New Methods for the Sporulation and Purification of Coccidian Oocysts. Sporulation rates greater than 85% of oocysts in large quantities of fecal suspensions (9 liters) have been made by using spinner flasks and constant aeration. The flasks permit magnetic stirring without the damaging grinding effect of conventional stirring bars. By employing progressively dilute sucrose solutions (1 M to 0.1 M), large quantities of oocysts can be purified in less time than previously possible. The technique of floatation previously used in purification required 120 man hours to harvest the oocysts from 4 liters of fecal suspension. With the new technique, this harvest is accomplished in 4 man hours--a saving of 116 man hours. Added

advantages of the new technique are the elimination of sieving fecal material before use and a sporulation rate to 95% or better. (I) Beltsville, Maryland. 21-E

New Device for Separating Larval Nematodes from Fecal Debris. A new device was made to separate large numbers of nematode larvae from fecal debris for experimental use. Plexiglas panels were fitted together to form a square tube with overlapping baffles sloping downward at different angles. The unit was placed inside a glass cylinder that was filled with warm water. Feces containing larvae were placed inside at the water surface. Larvae gravitate downward from one baffle to another, leaving most of the debris on the slopes. Larvae can be recycled through the unit as many times as necessary to achieve greater cleanliness. The unit is very efficient, easy to clean, and maintains larvae at a high level of viability. (I) Auburn, Alabama. 21-E

Incidence of Subclinical Demodicosis in Farm Animals and Deer. Examinations of farm animals and, where available, wild animals, are being made to determine the extent and epidemiological significance of subclinical demodectic acariasis. The study is confined to the eyelids, obtained on necropsy and subjected to a maceration-floatation technique. Demodectic mites were found in 57.1% of the horses examined. Ponies from Indian reservations in New Mexico and Arizona were the chief hosts. This percentage is the highest incidence ever reported in horse eyelids. In cattle from numerous locations in the U.S.A., the incidence was 10%; in goats from the southwestern States, 12.5%; in sheep from the Southwest, 0.0%; in swine from the Southwest and Midwest, 33%; and in New Mexico deer, 0.0%. (I) Albuquerque, New Mexico. 21-E

Optimum Inoculum Determined for Establishing Infections with a Ruminant Nematode in Guinea Pigs. A single dose of 5,000 infective larvae was the optimum inoculum to establish infections with the ruminant nematode parasite, Trichostrongylus colubriformis, in guinea pigs. Repeated halving of the inoculum to as low as 625 larvae resulted in the establishment of the same average percentage of the dose. Repeated doubling of the inoculum to 160,000 larvae resulted in lethal infections. A dose of 10,000 larvae was lethal in 11 days, 20,000 in 10 to 11 days, 50,000 in 7 to 12 days, 80,000 in 4 to 7 days, and 160,000 in 48 hours to 6 days. The guinea pigs apparently died because of massive leakage of serum albumin into the lumen of the gut. This condition is essentially similar to shock caused by massive trauma. (I) Beltsville, Maryland. 21-E

Effect of Antioxidant in Feed on Abortions and Stillbirths in Rabbits.

Studies concerning the relationship of rabbit abortion and antioxidant used in commercial feed preparations (Santoquin, Ethoxyquin, or E. M. Q.) have been concluded. Female rabbits were divided into groups which were fed diets containing one of the following levels of the antioxidant: No antioxidant, a commercial level of antioxidant (0.0025%), 2x commercial level, and 4x commercial level. The rabbits were maintained on their respective diets from at least 10 days prior to breeding to 2 weeks following parturition. Results of these experiments show no evidence that the antioxidant at any of the levels used in the feed was related to abortions or stillbirths in rabbits. (I) Auburn, Alabama.

21-E

Trichostrongylus affinis--Rabbit, Host-Parasite System under Intensive Study. Rabbits artificially infected with T. affinis were still passing eggs of this parasite 214 days later. Doses of 20,000 infective larvae were lethal to two rabbits that died 2 weeks after inoculation. Detailed information is being developed on the life cycle of T. affinis, which may differ from that of the Trichostrongyles of ruminants, in that the larvae undergo a tissue phase during which they are embedded in the mucosa of the large intestine. Observations are to be made on the biochemical changes resulting from the infection and these changes correlated with the life history of the parasite and immunologic and pathologic aspects of the infection. (I) Beltsville, Maryland.

21-E

Rocky Mountain Bighorn Sheep, and Domestic Sheep and Cattle Have Many Parasites in Common. Specific determinations of the parasites collected from 18 bighorn sheep from three separate localities in Montana and of specimens in the parasite collection at the Beltsville Parasitological Laboratory, have revealed that bighorn sheep populations at separate localities within a State may have totally different gastrointestinal nematodes, and that bighorn sheep are parasitized by 51 species, rather than 34, as previously believed. Seventy percent of these 51 different species are known parasites of domestic sheep and 35 percent of cattle in North America. The evidence indicates that there is an interchange of parasites between bighorn sheep, and domestic sheep and cattle. (I) Beltsville, Maryland.

21-E

Effects of Internal Parasites on Digestion. Digestion and absorption of protein labelled with radioactive iodine (I 131) was measured in parasitized mice. Eighty-seven mice were infected with the nematode Nematospiroides dubius and then fed the labeled protein at various intervals. The level of resulting parasitism did not affect the capabilities of the mice to digest and absorb protein as compared to non-infected controls. (E-fg) Colorado Agr. Exp. Sta.

21-F

Biology, Control and Vector Potential of the Face Fly, Musca Autumnalis Degeer. No pathological symptoms were evident when pathogens from eyes of cattle suffering from pink eye were inoculated into eyes of calves protected from insect attack. Mechanical trauma did not initiate pathological symptoms in the absence of pathogens. Results indicated that the face fly could qualify as mechanical irritant and as a vector for pathogens. (E-fg) S. C. Agr. Exp. Sta. 22-C

The Seasonal Incidence of Clinical Demodicosis in Dairy Cattle. A year-long study of clinical demodicosis, manifested by the presence of visible or palpable cutaneous nodules or vesicles, involved approximately 2,750 southwestern dairy cattle of all ages. The incidence of lesions from November 1966, to May 1967, was maintained at less than 1%. During June, the incidence rose sharply, attained an 18% level during July, and fell abruptly during August. By the close of September, the level had dropped to about 2% involvement. Lesions were observed only on heifers and cows 2 years of age and older, and only on lactating cattle; young stock and bulls were not infested. The relationship of the clinical evidence of demodicosis to the availability of green feeds and other summer environmental factors remains to be determined. (I) Albuquerque, New Mexico. 23-E

Laboratory Cultivation of Livestock Nematodes. The ability of the parasitic stages of Cooperia punctata to retain infectivity and reproductive potential during prolonged cultivation in the laboratory was demonstrated. When in-vitro grown worms were surgically implanted in the rabbit they produced viable eggs. Thus the germinal cells of the nematode are not irreversibly damaged during cultivation, although laboratory completion of the reproductive cycle has not yet been achieved in the test tube. (E-fg) Fla. Agr. Exp. Sta. 23-F

Drug Resistant Coccidia May Regain Sensitivity to Coccidiostats. Protozoan drug resistance, unlike that of most bacteria, is relatively stable and persists even when strains are propagated in the absence of the drug. The degree of resistance in two experimental strains of avian coccidia was undiminished after 10 passages through unmedicated chickens. One of these strains (resistant to amprolium) was concomitantly passed through chickens fed a low-level of acriflavine. After 10 passages, this strain had reverted, and again was sensitive to amprolium. These results indicate that drug resistance in coccidia is not irreversible and provide a lead to a possible method of combating this serious and persistent problem of the poultry industry. (I) Beltsville, Maryland. 24-E

Poultry Coccidia Develop in Bovine Kidney Cells. A chicken coccidium (Eimeria necatrix) and a turkey coccidium (E. meleagrimitis) completed

one full generation of schizonic development in monolayer cell line cultures of bovine embryonic kidney. They did not develop in primary cultures of bovine kidney or in cell line cultures of human, porcine, or ovine kidney. Continued attempts to infect cell cultures from poultry and other farm animals with poultry coccidia are shedding new light on the mechanism by which coccidia penetrate cells and the reasons for cell- and host-specificity. (I) Beltsville, Maryland. 24-E

Coccidiosis Facilitates Blood Stream Invasion by Salmonella. Chicks infected simultaneously with intestinal coccidia (Eimeria necatrix) and Salmonella typhimurium or S. pullorum showed a much greater bloodstream invasion of salmonella than did chicks without coccidiosis. The greatest numbers of salmonella passed from the intestine into the bloodstream on the sixth day after inoculation and coincided with the time of greatest mucosal destruction by the coccidial parasite. (E-fg) Tenn. Agr. Exp. Sta. 24-E

New Coccidia of Turkeys Characterized. Two new species of coccidia which may cause disease in turkeys have been discovered and characterized. Growth cycles and conditions conducive to disease have been determined. Present evidence indicate that these new species are not as pathogenic for turkeys as Eimeria adenoeides, E. gallopavonis and E. meleagrimitis. (E-fg) Ala. Agr. Exp. Sta. 24-E

Gapeworm Hemoglobin. The study of gapeworm and turkey hemoglobins was continued to determine the function of the parasite hemoglobin. The iron contents of gapeworm and turkey hemoglobins were similar--0.33 and 0.36%, respectively, but the parasite hemoglobin had a lower molecular weight--38,000 as compared to 65,000 for the host hemoglobin. Furthermore, the parasite hemoglobin had four peptides not found in the host while the turkey hemoglobin had about four peptides not found in the parasite hemoglobin. Finally, the parasite hemoglobin had no Bohr effect and bound oxygen more tenaciously than did the host hemoglobin. (I) Beltsville, Maryland. 24-E

Sex Steroids in Nematodes. Investigations are underway to determine if sex hormones found in higher animals also occur in nematodes. Studies of the poultry roundworm, Ascaridia galli, have revealed compounds tentatively identified as estrone, estradiol, and estriol. In-vitro culture techniques are being developed to assist in conclusive determination on whether these steroids are derived solely from the parasite or may be passed on to the parasite from the host. (E-fg) Kans. Agr. Exp. Sta. 24-F

Restudy of Two Helminthic Parasites of Swine Leads to Redescription of Life Cycles. Larvae of Ascaris lumbricoides and Stephanurus dentatus

undergo development and elicit an immunologic response during migration through host tissues. Time and location of molting from stage to stage, and rate of development are critical for understanding host-parasite relationships and formulating control measures. Contrary to previous reports, it was shown that Ascaris larvae molt in the intestinal wall soon after hatching, but do not molt again until migration is completed. Stephanurus larvae were shown to undergo obligate development in lymph nodes; heretofore, larvae found in this site were considered aberrant. (I) Beltsville, Maryland. 25-E

Swine Kidneyworm Antigens. Two treatments of swine kidneyworm extract with DEAE-cellulose ion exchange resin removed nonspecific antigens detectable in agar double diffusion tests against serums from normal swine. Disc electrophoresis of the excretory gland extract showed 20 protein bands representing at least 11 antigens--9 specific and 2 nonspecific. (I) Beltsville, Maryland. 25-E

Population Components of Psoroptes ovis. A contribution to the biology of the oversummer latency, or dormancy of scabies on sheep and cattle has been made. When aggressive strains of P. ovis are involved, only the total population is reduced during summer months. Parasite developmental stages within the population bear approximately the same numerical relationship to each other, and to the whole population, throughout the year. The influences responsible for summer depression of population pressure and pathogenicity of P. ovis are yet to be determined. (I) Albuquerque, New Mexico. 26-E

Use of Laser to Destroy Oocysts in Culture. Preliminary tests were made on the effects of a laser beam on the infective oocysts of coccidia of sheep. An electronic flash passed through a ruby to form a monochromatic light at a wavelength of 6493A units and was then collimated by passing through a small aperture and then through a research microscope that focused the intense beam on oocysts. Varying the energy from 170 to 230 joules produced oocyst damage ranging from small steam bubbles in the protoplasm to cracked oocyst walls, and finally complete disintegration. (I) Auburn, Alabama. 26-E

Progress in Rearing Oestrus ovis in vitro. In 46 of 120 cases, second instar larvae of O. ovis, the nasal botfly of sheep, successfully underwent ecdysis and became third instars in from 1 to 17 days on a modified tissue culture medium. None of these larvae survived to become mature third instars, but some of them lived as long as 18 days after ecdysis. Their longevity was extended when the medium was alerted by the addition of more protein and more vitamins. Although apparently beneficial to third instars,

the high protein-vitamin medium seems to be detrimental to second instars. Work is progressing on the development of a medium which will support first instars, and on the improvement of the present medium so that newly molted third instars can be reared to maturity. (I) Albuquerque, New Mexico. 26-E

Inanimate Objects and Animate Vectors in the Spread of Sheep Scab Mites. When introduced into contaminated pens up to 4 hours after infected sheep have been removed, clean sheep may regularly be infested with Psoroptes ovis, the mites which cause common sheep scabies. In 8 trials involving longer periods of pen evacuation, one of four attempts to infest clean sheep after 24 hours of pen vacancy was successful while four other attempts after 48 to 96 hours of vacancy were unsuccessful. Eight blackbirds, housed with separate pens of six infested and six clean sheep, did not spread an intense infestation of scabies mites from one to the other in a 4-month period from April to August. (I) Albuquerque, New Mexico. 26-E

Greater Susceptibility of Colostrum-Deprived, Parasite-Free Lambs to Infection with Gastrointestinal Helminths Confirmed. Further experiments with 25 lambs confirmed previously results with a much smaller number of comparable lambs that colostrum-deprived parasite-free lambs are more susceptible to the effects of parasitism with the large stomach worm, Haemonchus contortus, than lambs raised to weaning with their dams. The colostrum-deprived lambs had a lower rate of gain, had more pathologic changes at necropsy, and had a higher mortality rate than the lambs raised with their dams. (I) Beltsville, Maryland. 26-E

Six Species of Thread-Necked Strongyles Parasitize Domestic Sheep in the United States. Specific determinations of intestinal thread-necked strongyles in 90 collections of parasites from 21 States revealed that 6 species of Nematodirus parasitize domestic sheep, and not 4 as previously believed. Furthermore, the various species have been confused with one another in publications, and it has been determined that N. abnormalis, previously considered rare, is the second most common species. The six species, in descending order of their incidence, are: N. spathiger, N. abnormalis, N. filicollis, N. lanceolatus, N. helvetianus, and N. davtiani. The last-named species was described in Russia, and heretofore was not known to occur in this country. (I) Beltsville, Maryland. 26-E

Intramuscular Injections of Iron-Dextran Reduced Number of Large Stomach Worms in Sheep. Further studies on the use of intramuscular injections of iron dextran in lambs infected with the large stomach worm, Haemonchus contortus, revealed fewer worms in those lambs receiving the injections as compared to the number harbored by non-treated controls. No differences

in hematocrit levels of the two groups were detected during the 34-day period of observation from infection to necropsy. (I) Beltsville, Maryland.
26-E

Effects of Parasites in Lambs Being Measured. Studies are in progress to determine the effect of parasitism on normal physiological processes in lambs. Statistical analysis of data between parasite-free and Trichostrongylus infected lambs showed differences in weight gains only during part of the study. Differences were noted in blood acetone and B hydroxybutyrate levels during the study. There was no effect on blood pH or pyruvate. (E-fg)
North Dakota Agr. Exp. Sta. 26-F

Equine Piroplasmosis. The complement fixation test continues to be the most dependable serologic test being evaluated for the differential diagnosis of the two forms of babesiosis (piroplasmosis) affecting equines in the United States. Lyophilization of the diagnostic antigens and subsequent holding at a temperature of 5 C. has permitted storage for almost 6 months without loss of potency. Vectors (ticks) of the causal parasites were sterilized of their infections by feeding them for several generations on unnatural hosts (cattle). Studies of the life cycle of one of the causal parasites in the tick revealed that the agent develops through a uniform pattern of sequential stages to elongate infective forms in the salivary glands. The reproductive capacity of infected ticks may be adversely affected by the parasites. (I) Beltsville, Maryland.
27-E

Field Crops

Investigations of Mosaic and Other Virus Diseases of Cereals and Grasses. Maize dwarf mosaic virus (MDMV) was isolated from corn, grain sorghum, Johnsongrass and foxtail grass from several locations. Symptom expression on corn and sorghum varieties and experimental hybrids have been studied. Serial transmission of soil-borne mosaic virus (SBMV) in rye seedlings has been accomplished via water-root leachates from naturally infected wheat plants. Soil organisms are also being evaluated as vectors of the virus. (E-fg) Kans. Agr. Exp. Sta. 31-B

Biology and Control of Diseases of Oats and Wheat. Development of disease-resistant winter oat, wheat and barley breeding lines was continued. Additional biochemical studies on the germination of crown rust uredospores showed that proportionately large amounts of amino acids were released during the first hour of germination and continued to be released in lesser amounts throughout a 13-hour period. Sixteen of the amino acids have been

identified. Similar studies have shown that amino acids are released during germination of Helminthosporium victoriae spores and Sclerotium rolfsii sclerotia. The pattern of release by these two species is under investigation. (E-fg) Arkansas Agr. Exp. Sta. 32-B

Barley Yellow Dwarf Virus Disease of Small Grains. During late March and early April 1966 surveys revealed heavy infestation by greenbugs (Schizaphis graminum) on wheat from north-central Oklahoma to northern Kansas. Winds on April 10-11 and April 16 and 18 were strong enough to carry greenbugs from nearby Missouri and Kansas and possibly from Oklahoma to Iowa by April 24. On May 17 BYD symptoms appeared. BYD developed to epidemic proportions in Iowa as predicted from greenbug surveys in early May. Preliminary analysis of reports for 66 years of greenbug infestation in connection with temperature and rainfall data for November through April in Texas, Oklahoma, and Kansas suggests that below-normal precipitation during these months is associated with severe greenbug infestation and possibly also with severe incidence of BYD. Oklahoma may be the primary source of greenbugs for northward migration. In Texas population cycles may occur too early. Kansas may be a way station especially in years when the greenbug overwinters there. (I) Ames, Iowa. 32-B

Pythium aphanodermatum was demonstrated for the first time to be the causal agent of a seedling blight disease of oats, rye and wheat in Florida. (I) Gainesville, Florida. 32-B

Toxins Produced by Fungi. Of 25 Aspergillus flavus strains isolated from peanuts from six States, 16 produced high levels of aflatoxin B₁. On peanuts three strains produced high levels of G₁, also, seven gave low yields of B₁, and two were negative. Isolates from corn, rice, and other sources gave high yields of aflatoxin B₁. Two to three-year-old isolates from wheat, soybeans, and other grains produced little toxin. Deep vat fermentation studies showed that high aeration, organic nitrogen (yeast extracts), temperature, A. flavus strain, and level of inoculum influenced aflatoxin production. Age of inoculum and cultural medium are important factors in aflatoxin yield. Steam sterilization reduced aflatoxin levels in experimental peanut samples. (E-fg) Alabama Agr. Exp. Sta. 32-B

Bionomics of the Cereal Leaf Beetle. Laboratory compiled life tables indicate that the two main factors affecting reproduction activities are temperature and photoperiod. Optimum conditions are 80° F. and a 16-hour photoperiod. In some instances light conditions seem to have produced post-diapause conditions but results were confused by crowding. The critical period in rearing seems to be at the time of pupation. Adults have been refrigerated for 13 months with only 95% mortality. Leaf pubescence acts

as a mechanical barrier to oviposition and seems to have a major effect on the populations that can develop on a particular plant. Subsequent larval survival after oviposition is also reduced by pubescence. (E-fg) Mich. Agr. Exp. Sta. 32-C

CO₂ and O₂ in Cultures of Grain Weevils, *Sitophilus granarius*, *S. zeamais*, and *S. oryzae*. Highest concentrations of CO₂ were found at the base of the grain in quart-jar, open-at-top cultures and at the middle grain level in plastic culture jars open-at-both ends. Concentrations of CO₂ in insect cultures were as much as 87 times more than in laboratory atmosphere; laboratory atmosphere contained less CO₂ than in the rearing room. Of the 3 species, *S. zeamais* produced the most CO₂; the laboratory strain of *S. oryzae* produced more CO₂ than the field strain. The CO₂ increased to a peak concentration between the 22nd and the 26th day after the eggs were deposited. At this time the O₂ was at its lowest point. CO₂ decreased during pupation and increased again slightly as the insects became adults. (E-fg) Kans. Agr. Exp. Sta. 32-C

Insect Mutant. A true-breeding population of red-eyed Angoumois grain moths has been developed from descendants of a rare red-eyed male and a typical black-eyed female. The trait appears to be a recessive character. Further knowledge and use of the character may provide a valuable tool for other research. (E) Kans. State Univ. 32-C

Wheat, and Wheat-Sorghum-Fallow Rotations. In Kansas, long-term studies of a wheat-sorghum-fallow rotation indicate that maximum use of herbicides combined with minimum tillage causes a shift in weed species population from primarily broadleaf weeds to primarily weed grasses. Although the use of herbicides results in better weed control and higher yields, it now appears that some tillage is required for most effective crop production. (I) Hayes, Kansas. 32-D

Resistance of Wild Oats to Herbicides. Resistance to three herbicides was discovered in natural lines of wild oats. A wide range of response to these herbicides was observed and the degree of resistance to barban, a commonly used herbicide, indicated the presence of plants that probably would not be controlled with currently used rates of application. This research indicated the need for development of alternate control measures. Such additional research should include investigations of new herbicides and non-herbicidal methods of control. (I) St. Paul, Minnesota. 32-D

Fungus Vector of Soilborne Wheat Mosaic Virus. The fungus, *Polymyxa graminis*, carries the soilborne wheat mosaic virus to roots of wheat that is grown in soil bearing both the fungus and the virus. The virus appears to

be either firmly attached to the fungus zoospores or is inside of them. The virus cannot be removed from the zoospores with repeated centrifugation nor is it inactivated by antibodies to the virus. (I) Lincoln, Nebraska 321-B

Effect of Dockage in Wheat. Laboratory tests showed that confused flour beetle adults preferred wheat containing 1 to 4% of cracked wheat or elevator dust over cleaned wheat. Also, 30 to 40% more progeny developed in wheat with 4% dockage than in cleaned wheat. (I) Manhattan, Kansas. 321-C

Break-through in Nutrition Studies. A significant new finding is that larvae of the Angoumois grain moth will readily enter and grow in kernel-size pellets made up with various proportions of nutrients derived from wheat kernels. Comparative nutritional studies were previously impossible because newly hatched larvae bore into grain kernels and complete their development, about 35 days being required in wheat. Development required 140 days in a pellet made almost entirely of wheat endosperm. The period was reduced to 100 days when 1% of wheat germ was added. Further studies will be made with varied diets of controlled composition. (E) Kansas State University. 321-C

Resistance to Hessian Fly. Studies involving reciprocal matings between individual Hessian flies from Race A and B have shown that the inability of Race A to infest wheats having the H_3 gene for resistance is dominant to the ability of Race B to infest these same wheats. Inheritance studies involving the Great Plains race and Race A and B have shown there is chromosomal elimination of paternally derived chromosomes during spermatogenesis resulting in only one functional sperm having only maternally derived chromosomes. (I) Lafayette, Indiana. 321-C

Fertilizers Increased Wild Buckwheat Competition in Wheat. Wild buckwheat competition in wheat grown on fertilized soil at Fargo was more intense in wheat seeded at $3/4$ bu/A than when seeded at $1-3/4$ bu/A. With 20 wild buckwheat plants per sq. yd., the percent yield reductions were 31, 27 and 24 for the $3/4$ bu/A, $1-1/4$ bu/A and $1-3/4$ bu/A wheat seeding densities, respectively. When plots were not fertilized wheat yield reductions were generally less. (E-fg) N. Dak. Agr. Exp. Sta. 321-D

New Weed Hosts for Barley Yellow Dwarf Virus (BYDV). Six weed hosts in Mississippi are reported as being natural summer hosts for BYDV for the first time. They are: Bracharia platyphylla, Cyperus rotundus, Eleusine indica, Panicum ramosum, and Phalaris angusta. (I) Stoneville, Mississippi. 322-B

Dwarfing Virus Diseases of Corn. Research effort has been concentrated on a determination of viruses present in cereals which will also affect corn in Michigan. Five hundred collections from wheat and one hundred collections from corn were assayed for transmission of the disease with expressed plant juice. Sixteen virus isolates, six from wheat and ten from corn, produced essentially the same symptoms on both wheat and corn. On the basis of recent tests, all isolates are considered to be wheat streak mosaic virus (WSMV). It has consistently been found that the geographic distribution of the virus in corn in a given year is not consistent with the geographic distribution of the Kernel Red Streak disease of corn. It therefore appears clear that the virus present in only a limited geographical area in Michigan is not the cause of Kernel Red Streak which is widely distributed in Michigan. (E-fg) Mich. Agr. Exp. Sta. 326-B

Maize Dwarf Mosaic Corn Virus. At least two distinct strains of maize dwarf mosaic exist. One form attacks Johnsongrass, and it is suspected that this grass serves as a host for overwintering the virus which can be found from Tennessee and Arkansas and northward throughout the Johnsongrass territory. The other strain does not attack Johnsongrass and occurs north of the Johnsongrass area. Both strains are mechanically transmissible and aphids act as natural vectors. Sources of resistance have been found for the two strains of maize dwarf mosaic. (I) Wooster, Ohio. 326-B

European Corn Borer Deterrent. In studies on the biochemical nature of natural resistance of corn to the European corn borer, it was shown that the compound 2,4-dihydroxy-7-methoxy-1,4-benzoxazin-3-one is an effective feeding deterrent for larvae of the European corn borer. It has been concluded that this compound is a major factor in the natural resistance of corn to the European corn borer. (I) and (E) Ankeny, Iowa. 326-C

Corn Plant Population Influences Weed Ecology. There was a decrease in the yield of weeds in the corn populations of 16,000 plants per acre as compared to 8,000 plants per acre. Average corn height was reduced on the weedy plots. Weeds reduced the ear weights over 20 percent when compared to the weed-free treatments; the ear size was decreased by the increase in population. There were no significant differences in shelling percentage. The corn yield was significantly higher at the 16,000 population, and the yield was decreased about 15 percent due to weeds. The percent of grain in fodder was about the same on the weed-free as the weedy plots. More dry matter was produced at the higher corn population. In another experiment, the stand of weeds decreased as the corn population increased. The yield of weeds decreased as the corn population increased and as the row width was decreased. (E-fg) Mo. Agr. Exp. Sta. 326-D

Quackgrass Inhibits Mineral Uptake by Corn. Use of the split-root technique has shown that the stunted growth of corn grown in association with quackgrass is due to an inability of the corn plant to secure sufficient mineral nutrients from the soil even though the elements are in abundant supply. The inhibiting effect is predominantly localized. Corn plants with one root in nutrient culture grew reasonably well even though the remainder of the corn root system was in quackgrass infested soil. Soil tillage initially before planting corn reduced the competitive effect, presumably due to aeration for the amount of quackgrass tissue involved was not changed. The release of a volatile, biologically active compound by the growing quackgrass is suspected. (E-fg) Wisconsin Agr. Exp. Sta. 326-D

Witchweed Seed Germinates in the Absence of a Chemical Stimulant. The seed of witchweed can germinate in the absence of the natural chemical stimulant released by corn and other members of the grass family, if the radicle end of the seed is punctured. Before this recent discovery, we were unable to induce germination in the absence of a germination stimulant. Also, it was learned that light is inhibitory to germination of witchweed seed if they are exposed during the latter part of the pregermination period. These findings represent significant progress in our attempts to find ways of breaking or inducing dormancy of weed seed. Ability to control germination of weed seed would be a major step forward in our efforts to develop safe, efficient control measures. (I) Whiteville, North Carolina. 326-D

Charcoal Rot of Grain Sorghum. It has been determined that, in grain sorghum, the expression of susceptibility to charcoal rot depends on a combination of factors including stage of grain development, high temperatures, and water stress. Therefore, the evaluation of selections under test for resistance or susceptibility may require screening under different environments. (E) Arizona Agr. Exp. Sta. 327-B

Root-knot Nematodes are Associated with Grain Sorghum on the High Plains of Texas. The nematodes that increase on sorghum subsequently do great damage to cotton in that area. Field experiments at Lubbock show that nematocide treatment of grain sorghum increase yields 15-25% (780 and 960 lbs/A) in two field tests where cotton rootknot nematodes were controlled, indicating the potential of nematodes in limiting grain sorghum production as well as posing a problem for subsequent crops of cotton. Thirty breeding lines of grain sorghum were tested at Lubbock for susceptibility to the cotton root-knot nematode; best plant growth and lowest root-knot infections were for Runnels #11 Broomcorn, and PL 35038 Sumae; in all other lines and varieties tested, root-knot reduced grain sorghum growth by as much as 44 percent. (I) Lubbock, Texas. 327-F

Bromegrass Midge. Preharvest head samples of bromegrass indicated that a midge, Stenodiplosis bromicola, caused 66 percent of the seed to be abnormal. (I) Lincoln, Nebraska. 331-C

Grasshoppers. In a study of the food plants of grasshoppers it was shown that grasshoppers appeared earlier and developed more rapidly in cultivated pastures than on rangeland. (E) Kansas State University. 331-C

Nature of the Influence of Crop Residues on Phymatotrichum Root-Rot of Alfalfa. Continued research has been concerned with the physiology of Phymatotrichum omnivorum. A wide array of enzymes is present in this fungus based on the various carbon sources used by the fungus as an energy source. Starved mycelium responded to a number of exogenous substrates as measured manometrically by an increased oxygen consumption relative to the rate of endogenous respiration. The fungus is capable of utilizing most sugars and a disparate array of organic acids as an energy source. Mitochondrial preparations of the fungus were studied in various media to determine the potential for utilization of various organic acids. The preparations did not appear capable of utilizing succinate or fumarate; however, they readily catalyzed the oxidation of malate, malonate, α -ketoglutarate and oxalate. (E-fg) Nevada Agr. Exp. Sta. 332-B

Alfalfa Weevil. The normal summer diapause of the alfalfa weevil was effectively terminated by topical application of the synthetic hormone, 10, 11, epoxyfarnesenic acid, methyl ester. A dosage of 100 mg. resulted in increased activity and feeding in 3 days and oviposition in 7 days. (I) Beltsville, Maryland. 332-C

Lygus Bugs on Alfalfa. Most nymphs and adults of lygus bugs died when confined to eight different growth stages of Moapa alfalfa. Lygus bugs failed to develop satisfactorily when confined to plants representing growth stages from seedling to bud. (I) Mesa, Arizona. 332-C

Studies of Ditylenchus dipsaci Indicate that Nematodes Invade Equally the Apical Meristem of Susceptible 'Ranger', and Resistant 'Kayseri' and 'Lahontan', Alfalfa Varieties at temperatures ranging from 5 to 30° C. but the nematode did not reproduce equally in resistant and susceptible varieties. At lower temperatures 'Kayseri' and 'Lahontan' maintained good resistance to the nematode, but in the temperature range 20-30° crown-galling occurred, indicating that penetration by the stem nematodes and plant resistance in alfalfa is dependent on a temperature regulated factor. In the root-knot resistant 'African' alfalfa, the nematode enters the roots but soon migrates out, while in the highly root-knot susceptible 'Lahontan', the larvae enter the roots and giant cells form in the usual manner, indicating

that in some resistant plants nematodes do not remain in the roots but migrate out looking for suitable feeding sites. (I) Logan, Utah. 332-F

Insects for Control of Mediterranean Sage. For several years the most important factor preventing the introduction of a species of Phrydiuchus beetle to control Salvia aethiopis in the United States has been the possibility that it feeds on an alternate host, possibly a beneficial plant, during its aestivation period. As the result of an intensive two-month search in France, the aestivation site of this beetle was finally located among crowns of Graminae in the shade of isolated trees in the infested area. This discovery brings the introduction of this potentially valuable insect one step closer. (I) Gif-sur-Yvette, France. 334-D

Musk Thistle, A Spreading Problem. Musk thistle is a spreading biennial weed problem in Midwest pastures and noncultivated lands. A survey in Nebraska indicated that this weed had spread in all areas except the Sandhills. In a special study at Lincoln, Nebraska, musk thistle bloomed in the first week of June in 1965, regardless of when it was planted in 1964--13 dates of planting were used from June 3 to September 3. It was shown that musk thistle was able to become established in even the best pastures. Musk thistle seeds placed in different pasture types in the spring under three different levels of management (continuous grazing; grazing deferred and rotated; and protected from grazing) resulted in the establishment of the most rosette plants at the end of the growing season in smooth brome grass and intermediate wheatgrass pastures that were protected from grazing. Plants also became established in bluegrass pastures. The smallest number was in the warm season grass mixture protected from grazing. The time of spraying herbicides is critically important. Excellent control resulted from 1-1/2 to 2 pounds per acre of an ester of 2,4-D if applied between April 30 and May 10 when plants were in the full rosette stage of growth and just before stem elongation in the spring. Other herbicides also show promise in controlling this weed. (I) Lincoln, Nebraska. 334-D

Weed Control and Fertilizer Restore Pasture Productivity. A 30-year-old crested wheatgrass pasture was restored to high productivity by control of fringed sage with 2,4-D and applications of 40 lb. N/acre/year. After highest production the first year of grazing the pasture declined from 133 lb. beef/acre to an average of 70 lb. the last 7 years of the 30-year period. Control of sage and fertilization for 4 years resulted in a 4-year average productivity of 159 lb. beef/acre. The highest monetary return over the cost of treatment was for spray only, but a combination of spray and N produced 70 percent more forage. (I) Mandan, North Dakota. 334-D

Controlling "Spring Dead Spot" in Bermudagrass. The spring dead spot disease was found to be unrelated to levels of potassium in the soil or in bermudagrass sprigs. Two fungicides, nabam and a coordination product of zinc ion and [ethylenediamine (dithiocarbamate)] manganese, gave effective control of the spring dead spot disease when applied at 3 monthly intervals in the fall at 8 oz/1000 sq. ft. and watered into the turf with 1/2 inch of water. Less frequent applications were not successful. (I) Tifton, Georgia. 335-B

Biology of Phytophthora Rot in Soybeans. Cross-protection of susceptible Harosoy against Phytophthora megasperma var. sojae was accomplished using the non-pathogens Helminthosporium sativum, H. turcicum, Ceratocystis fimbriata, and Gibberella zeae. It appears these organisms can stimulate the production of phytoalexin in soybean as a defense against P. megasperma var. sojae. (I) Urbana, Illinois. 341-B

Green Stink Bug Possible Vector of Soybean Yeast-spot. Studies revealed that the organism causing yeast-spot disease of soybeans was harbored in the salivary system of the green stink bug Acrosternum hilare. This provided the first conclusive evidence that the insect vector and the organism were intimately associated in the transmission of the disease in soybeans. These findings provide guidelines for the reduction of this damage which is of concern to producers and processors of soybeans in Missouri and elsewhere. (E-fg) Mo. Agr. Exp. Sta. 341-C

The Relationship Between Strains of Plant Viruses. Field plot work on peanut stunt was conducted at various locations. Emphasis was placed on determining resistance to peanut stunt in 309 peanut cultivars. In addition, 25 agronomic and horticultural host plants were included to determine their susceptibility to the virus under field conditions. Greenhouse tests indicated that several of these hosts are susceptible. Although none of the peanut lines tested were immune to peanut stunt, some were significantly more resistant than others. Seed was harvested from peanut stunt-infected plants and subsequent seed transmission studies were conducted. It was found that peanut stunt was transmitted in less than one percent of the seed. (E-fg) Va. Agr. Exp. Sta. 344-B

Diet Influences Life Cycle. When the almond moth was reared at 27° C. and 60% relative humidity, the life cycle from egg to adult averaged 23.2 days on a laboratory culture medium but required 10.3 days longer on shelled Spanish peanuts. The life cycle of the Indian-meal moth was 1.3 days shorter on the culture medium and 2.1 days shorter on Spanish peanuts. (I) Tifton, Georgia. 344-C

Lesser Cornstalk Borer Injury on Peanuts. Artificially infesting peanuts with eggs of the lesser cornstalk borer showed that the larvae damage the pods and pegs and the plants near ground level and that the degree of damage was associated with infestation level. (I) Tifton, Georgia. 344-C

Translocation of Organic Molecules in Plants. Research has implicated xylem tissue as the major site of transport of pesticides absorbed by plant organs. Patterns of distribution of pesticides are consistent with xylem traces in plant stems. An homologous series of isotope labelled fatty acids (C2 through C12) have been used to obtain information on effects of molecular size and configuration on translocation patterns. The amount of fatty acids translocated increased as the molecular weight increased. Acids with odd numbers of carbon atoms accumulated in leaves in greater quantities than those with even numbers. (I) College Station, Texas. 351-A

Mode of Infection--Verticillium Wilt. The root of the cotton plant serves as an inoculum source and conidia produced by the invading mycelium move at random throughout the plant in the xylem fluid. Tolerance to the disease appears to be associated with a smaller number of conidia produced in the roots of tolerant plants, resulting in a lower inoculum potential in the plant. Histological studies of hypocotyla and epicotyls of developing seedlings indicate that the endwalls of the maturing xylem vessels open up gradually from the base of the hypocotyl upward with increasing age of the seedlings. In a 7-day-old seedling, conidia are able to move upward only very short distances; whereas, in 21-day-old seedlings, conidia are able to move freely up into the tops of the plants. (I) Beltsville, Maryland. 351-B

Metabolites of *Alternaria tenuis* Prevents Chlorophyll Formation. The fungus, *Alternaria tenuis*, isolated from diseased cotton seedlings, produces an active fraction in liquid culture which prevents the formation of chlorophyll in many dicotyledonous plants. The fungus metabolite apparently is active only in the dark and has no effect on seedlings that have already formed chlorophyll. It has been isolated and characterized as a cyclic polypeptide. The material is of interest as a potential selective herbicide. (I) Fayetteville, Arkansas. 351-B

Discovery of Phytoalexin in Xylem Sap. Biologically active materials have been found in the xylem sap of verticillium infected cotton plants. The phytoalexin-like materials formed in the plant apparently are the result of host reaction to infection. The active material is produced in naturally infected plants as well as in incubated stem sections artificially infiltrated with verticillium conidia. The biologically active material in sufficient concentration is capable of retarding or completely inhibiting the development of the verticillium fungus. The activity of the material appears to be

correlated with the degree of tolerance in the host. (I) Beltsville, Maryland, and Davis, California.

351-B

Synthetic Homologs of Propylure Attract Pink Bollworm. Several homologs of propylure, the pink bollworm sex attractant, that have been synthesized recently show attractancy for the male pink bollworm moths. (I) Beltsville, Maryland.

351-C

Boll Weevil on Wild Cotton. In a continuing study of the boll weevil and its relatives, weevils were collected on wild cotton in Arizona and reared through six generations on artificial media and on cultivated cotton. The sixth generation weevils were found to resemble much more closely the weevil that is normally found on cultivated cotton than those originally collected on wild cotton. Ecological and taxonomic notes on as many close relatives of the boll weevil as possible are being brought together in a summary of our knowledge about this insect. (E) Texas Agr. Exp. Sta.

351-C

Cotton Constituent Attractive to Boll Weevils Isolated. A compound known as beta-bisabolol [(+)-1-(1,5-dimethyl-4-hexenyl)-4-methyl-3-cyclohexenol] has been isolated from cotton squares and shown to be an important attractant for boll weevils. (I) State College, Mississippi.

351-C

Feeding Stimulant for Boll Weevil Formulated. Testing of various compounds and mixtures as feeding stimulants for the boll weevil has led to formulation of a mixture that is as active as aqueous cotton-bud extract in stimulating punctures by the weevils. (I) State College, Mississippi.

351-C

Sterilization of the Boll Weevil. Male boll weevils sterilized by radiation are not competitive because the high dose required also damages the midgut and causes starvation. Certain chemosterilants do not affect the midgut but do sterilize the sperm and older germ cells. However, they do not cause permanent sterility because they are ineffective against the spermatagonia. Those early germ cells can be destroyed by only one fourth the dose of radiation needed to sterilize the sperm. Tests with combination treatments are underway using chemicals to produce sterility in the sperm and older germ cells and radiation to destroy the earliest stages in sperm development. (I) Fargo, North Dakota.

351-C

Honeycomb-like Traps Were Efficient in Rearing Tobacco Budworms. A rectangular tray containing a honeycomb like device made from polyester to separate larvae developing on artificial medium used to rear tobacco budworms saved labor and materials compared with the plastic cup method. The honeycomb cells were infested with eggs instead of newly hatched larvae

used in the cup method. An average of seven pupae were obtained per 10 cells. (I) Brownsville, Texas. 351-C

Brown Spot Disease of Tobacco. A Kramer-Collins spore trap was operated at the Oxford, North Carolina, Tobacco Research Station from June 29 to October 17. Temperature, rainfall, relative humidity, dew duration, spore numbers and time of spore release were related to infection by Alternaria tenuis and development of brown spot. Infection on the lower leaves appeared in mid-July. Thereafter the total number of spores trapped per 24-hour period was greatest following 12 to 14 hours of high relative humidity or at least 0.1 inch of rain. Temperature had little effect on spore numbers. Spore liberation was most rapid between 10:00 a.m. and 2:00 p.m. but on some days numerous spores were trapped until 6:00 p.m. Infection on surrounding tobacco plants was greatest from 5 to 7 days following a period of rain with low temperatures (70° to 75° F.). This information represents only one very dry season at the Oxford station. Spore trapping studies (vane type traps) indicate that Alternaria spores will be produced during the winter on infected tobacco stalks left standing in the field whenever temperatures range above 60° F. (I) Raleigh, North Carolina. 36-B

Studies of Host-Parasite Interactions Using Plant Tissue Culture Techniques. Tobacco callus cultures infected with tobacco etch virus (TEV) were sub-cultured for a period of 20 months at three- to four-week intervals on a chemically defined nutrient medium. At the end of each sub-culture, tissues were checked for virus infectivity by mechanical inoculation of tobacco. TEV was still effective after 29 sub-cultures in this system. Studies were also conducted on the detection of phytochrome in callus tissues of tobacco. Tissues were grown under various light-dark regimes and under different qualities of light. It was found that the level of phytochrome was about equal in dark-grown and red-light irradiated tissues. However, tissues grown in white light had less photometrically detectable phytochrome than the above treatments. (E-fg) Kentucky Agr. Exp. Sta. 36-B

Tobacco Hornworm Flight. Recovery of marked moths indicated that dispersal was primarily in random directions. Flights across or into the wind predominated at times. Males released at varying distances and directions from caged virgin females frequently flew upwind to find the females. Upwind dispersal was believed to be predicated upon the perception of attractive odors. One flight of 14 miles in 2 nights was recorded. (I) St. Croix, Virgin Islands. 36-C

Investigations on the Soil-Inhabiting Nematodes Associated with Sugarcane and Their Control. Various experimental designs and techniques have been used to evaluate nematodes as vectors of soil-borne viruses. Results to

date indicate that nematodes are not required for transmission of chlorotic streak of sugarcane. Studies on the effects of phytopathogenic nematodes on the enzyme system and respiratory enzymes of sugarcane indicate that Xiphinema sp. greatly inhibits sugar formation. Infections by Trichodorus christei were not as pronounced as those by Xiphinema. Studies on the chemical control of sugarcane nematodes showed that significant increases in cane yield and sugar yield were obtained from plots that received only two gallons of Nemagon EC-2 the second year and from those plots that received 66 gallons of DD the first year followed by four gallons of Nemagon EC-2 the second year. (E-fg) Puerto Rico Agr. Exp. Sta. 371-F

Hosts of an Ephydrid Leaf Miner, a New Pest of Sugarbeets. The ephydrid leaf miner, Psilopa leucostoma, a newly discovered pest of sugarbeets, was found to attack the Halberd-leaved Orache--a saltbush--Atriplex hastata, and the common lambsquarters, Chenopodium album. (I) Yakima, Washington. 372-C

Sugarbeet Root Maggot Ecological Studies. Sugarbeet root maggots overwinter in the larval stage 6-9 inches below the soil surface. Adult flies emerge from the soil from May to August with peak emergence in early June. Male flies are sexually aggressive the day of emergence whereas females are not receptive to mating for approximately 3 days after emergence. Raw sugarbeet juice was found to be an effective attractant for adult flies. (I) Twin Falls, Idaho. 372-C

Competition of Weeds with Crops. Often the control of weeds in agronomic crops is expensive, and may cause undesirable side-effects. Thus, knowledge about losses associated with lack of control is important. Research in progress indicates that the greatest protection to yields of several crops comes from early control of weeds. For example, sugarbeets yielded well if: (1) weeds were allowed to compete during the first 8 weeks only; or (2) weeds were prevented from competing during the first 3 to 5 weeks after planting sugarbeets. Allowing weeds to compete later in the first example; or start competing earlier in the second example, resulted in drastically reduced yields. This research indicated that failure to control weeds in sugarbeets may result in essentially complete loss (96%) of the crop, and that poor timing of control can result in losses equalling 40 to 50 percent of the potential yield. (I) Fort Collins, Colorado. 372-D

Horticultural Crops

Centers of Origin of Crop Plants and Their Insect and Disease Pests.

Phytogeographic studies of the genera Cucumis (cucumbers and melons) and Phaseolus (beans) and their insect and disease pests have provided substantive information on probable primary and secondary centers of origin of these economic plants. These studies provide guidance to future plant explorations for new germ plasm carrying genetic factors for resistance to insects and diseases. (I) Beltsville, Maryland. 41-A

Grape Viruses in California. Of the 8 viruses that occur on grapes in California, leafroll and corky bark are 2 of the most harmful. By differential heat therapy, vines have been obtained during the past year that are free from leafroll, but still infected with corky bark virus, indicating these viruses are unrelated. Plants of 14 rootstock varieties and 90 scion varieties that are free of all detectable viruses are now growing in the foundation vineyard at Davis and propagations are being distributed by the California Grape Certification Program. (I) Davis, California. 41-B

Blueberry Cane Canker. In a study of the cane canker fungus (Botryosphaeria corticis) in North Carolina, 14 isolates when grown on 5 different substrates produced most pyrenidia on oatmeal agar. Occurrence of races of the fungus was verified when spores of 8 isolates were placed on plants of 16 varieties of blueberries. (E) Raleigh, North Carolina. 41-B

Raspberry Viruses. Seed transmission occurred with chlorotic leafspot virus in 3 percent of blackberry seedlings grown from seed obtained from infected plants. New Logan Virus, which is latent in black and red raspberries, spread into clean stock in a field test. Pollen from infected plants was found to be viruliferous. (I) Beltsville, Maryland. 41-B

Strawberry Viruses. Strawberry plants have been freed of latent A and latent C viruses by heat treatment of plants and subsequent culturing of runner tips on nutrient agar under aseptic conditions. A clone of F. vesca from Moldavia, USSR, was found to be free of detectable viruses and to be an excellent virus indicator, especially for crinkle viruses. (I) Beltsville, Maryland. 41-B

Migration of Aphids. Yellow pan and suction trap aphid collections received from stations in Texas to Wisconsin were processed at the Aphid Identification Center. Microscope slide mounts of representative species were prepared, and a taxonomic study made of all species being trapped. Collection data and associated weather records for the period 1960-65 were punched on

IBM cards in preparation for a statistical analysis. (E-fg) Wisconsin Agr. Exp. Sta. 41-C

Comparative Biology of Related Species. It was discovered that many infestations in dried fruits and harvested tree nuts previously believed to be the saw-toothed grain beetle, Oryzaephilus surinamensis (L.) are actually the closely related merchant beetle, O. mercator (Fauvel). This raises many questions that need to be answered about comparative biology, ecology, habits, behavior, nutritional requirements, and food preferences. In comparative studies of the two species under constant conditions of 86° F., 50% relative humidity and low light intensity, each developed best on rolled oats plus yeast, next best on almonds, and rather poorly on raisins. Neither species did well on prunes where only a few saw-toothed grain beetles completed development from egg to adult and none of the merchant beetles developed to the pupal stage. The saw-toothed grain beetle did better on raisins than did the merchant grain beetle, and the latter did better on almonds. (I) Fresno, California. 41-C

Nematode Transmission of Plant Viruses. It has been shown that the grape fan leaf virus (FLV) is transmitted by a plant parasitic nematode Xiphinema index, although electron microscopy has not revealed virus particles in nematode tissues. Histochemical techniques have revealed that there is a higher concentration of RNA in viruliferous nematodes than in healthy specimens, particularly in the lateral chords. This suggests a higher protein synthesis activity and a possible site of virus production, or a similar activity induced by the presence of the virus. The nuclei in the hyperdermis are larger in viruliferous nematodes than in healthy ones. Field studies are in progress to determine methods of eradicating Xiphinema index and fan leaf virus from various grape vineyards. Other studies have shown that three species of the plant parasitic nematode Trichodorus transmit the tobacco rattle virus. Various species have been recorded as transmitting tobacco rattle virus to chili peppers, lettuce, and aster. It has also been shown that Xiphinema americanum transmits tomato ring spot virus to cucumber. (E-fg) Calif. Agr. Exp. Sta.; Davis and Riverside. 41-F

The Chemotherapy of Plant Diseases. Pectolytic and cellulytic enzymes have been implicated in the pathogenesis of wilt diseases. The recent studies on potato varieties resistant to Verticillium albo-atrum show that they synthesize chlorogenic acid more rapidly than susceptible varieties. It has also been shown that oxidized chlorogenic acid can inactivate pectolytic enzyme. Various phenolic compounds, evaluated for chemotherapy of Fusarium wilt of tomato revealed an unexpectedly high proportion of active compounds, in view of the random selection that was made. The compounds shown active in reducing wilt symptoms also showed marked ability to reduce

pectolytic enzyme activity. However, deviations from correlation do exist; for example, growth regulants known to have chemotherapeutic activity against Fusarium wilt of tomato also had growth regulant and chemotherapeutic activity but did not have high activity for inactivating pectolytic enzymes. (E-fg) Conn. Agri. Exp. Sta. 42-B

Culture Methods for Insects Attacking Vegetable Crops. Further study of the nutritional requirements of the European corn borer, Ostrinia nubilalis, and the cabbage looper, Trichoplusia ni, resulted in the development of meridic dietary media containing no crude plant fractions. Elimination of plant adjuvants, such as wheat germ, opens the way for detailed studies of specific requirements for vitamins, amino acids, etc., not previously possible. The development of an improved mineral salt mixture was an important step in the formulation of the new improved culturing medium. It was found that the salt mixtures previously used contained mineral ion ratios that were unfavorable for the insects, and that such mixtures also contained deleterious substances. Growth and survival of the larvae were greatly improved by the newly developed mineral formulation. (E-fg) Wisconsin Agr. Exp. Sta. 42-C

Interrelation of Nematodes and Other Pathogens in Disease Complexes. The fungus Verticillium albo-atrum was obtained from stems of certified potatoes 18 days after planting in soil infested with both the fungus and the nematode Meloidogyne hapla (internal symptom form), but not until 49 days in soil infested with the fungus alone. Verticillium was not obtained up to 72 days later in soil infested with the nematode alone. Potato plants from certified seed growing in soil infested with both the fungus and the nematode lived about 82 days as compared with 73 days in the absence of the fungus, and 99 days in pasteurized soil. Approximately the same relationship was found where noncertified seed and M. hapla (external symptom form) was used. Potato tubers infected with the external form of M. hapla sprouted sooner than noninfected tubers from the same source. Sprouts of the noninfected tubers became infected with Rhizoctonia whereas those on nematode-infected tubers were not infected with this fungus. (E-fg) Idaho Agr. Exp. Sta. 421-A

Physiology and Biochemistry of Nematode and Nematode-Host Relationships. A greenhouse experiment was designed to evaluate the combined effects of verticillium albo-atrum and Pratylenchus penetrans on potatoes. Significantly lower tuber yields were attained in the fungus-nematode treatment than in treatments with either fungus or nematode alone, when conidia of the fungus were used as inoculum. When fungus inocula consisted of microsclerotia combined with nematodes at each of five inoculum levels, significant interactions for the weights of both tops and tubers and inoculum level

were detected. Root yields were lowest at the highest nematode inoculum level. Wilt ratings were significantly higher in combined treatments than in corresponding treatments containing the fungus alone, and were greatest in the combination of the highest fungus and nematode inoculum levels. The nematode P. penetrans was tested for response to a variety of organic compounds. Of the 23 amino acids tested, lysine was the most attractive. Of the seven sugars tested, xylose was repellent. (E-fg) N. H. Agr. Exp. Sta. 421-B

Studies on Streptomyces Scabies--Its Distribution and Variability. One hundred fifty cultures of the potato scab organism Streptomyces scabies were tested for pathogenecity by inoculation of radishes grown in vermiculite. Only three of the isolates produced lesions. There appears to be some host specificity in strains of this species. Attempts to develop antibiotic-resistant cultures of this organism showed that (1) resistant strains may be sorted out, (2) this resistance may not be stable, (3) resistance to one antibiotic may mean resistance to several, possibly indicating some general form of resistance, and (4) crossover types were not found in mixed cultures growing on combinations of antibiotics. (E-fg) Alaska Agr. Exp. Sta. 421-B

Biology of Diseases Caused by Pseudomonas solanacearum. Although Pseudomonas solanacearum appears to be quite limited on the Island of Hawaii, three weed hosts have been found, e. g., Bidens pelosa, Ageratum conyzoides and Solanum nigrum. There is also rather strong evidence that P. solanacearum is present in sugar cane soils in Hawaii. This is unexpected and further investigations of this phenomena are underway. There is at present no evidence for insect spread of this bacterium under Hawaiian conditions. Over 1,100 isolates have been made and all are of the tomato race, although of considerable variability. Ginger may be mildly attacked by the tomato strain, but the ginger strain, highly virulent to ginger appears to be only on the Islands of Oahu and Kauai. (E-fg) Hawaii Agr. Exp. Sta. 422-B

Flea Beetle Injury on Tomatoes. Tobacco flea beetle larvae tunnel into tomato seedlings. The hypocotyls collapse, followed by plant prostration. These symptoms are remarkably similar to "damping off" and may have in the past been attributed to Rhizoctonia, Pythium, or other soil fungi infections. (I) Beltsville, Maryland. 422-C

Physiology and Biochemistry of Nematode and Nematode-Host Relationships. Using the split-root technique, in which half the tomato root system is exposed to the Fusarium wilt fungus alone and the other half to the root-knot nematode alone, it has been shown that if part of the root system is infected with root-knot, the rest of the root system becomes susceptible to the Fusarium wilt organism. The presence of the nematode in part of the root system apparently changes the physiology of the entire root system and renders it

susceptible to the fungus. Extracts of tomato plants treated in the above manner were subjected to thin layer and paper chromatography for amino acids. No differences were found which could be attributed to Fusarium wilt resistance-breaking. (E-fg) Pennsylvania Agr. Exp. Sta. 422-F

Downy Mildew of Lima Bean. Phytophthora phaseoli formed most sporangia within three days on established lesions in dew cabinets at 15°, 20°, or 25° C. More than 80 percent of the total number were formed on the first day. On plants exposed to the same light intensity for different daily periods of time during colonization a significantly greater number of sporangia developed within 16 hours as compared with 12 hours of light. Maximum colonization and much sporulation occurred under a fluctuating temperature regime of 20°/15°. The maximum rate of colonization and most sporulation (both rate and quantity) occurred at 27°/22°. Infection has been obtained from sporangia stored at -60° C. for one year. (I) University Park, Pennsylvania. 424-B

The Nature and Inheritance of Fusarium Root Rot Resistance in Beans. The quantities of pectin methylesterases in the hypocotyls and roots of five bean varieties were determined and compared. The variety known to be most resistant to damage by the Fusarium causing root rot of beans contained the smallest amounts of these enzymes. A new early maturing selection of N-203, not yet tested for resistance, contained even lower amounts. Five isolates of Fusarium from different bean growing areas of the State were used to test their effects on the pectin methylesterases of the hypocotyls of the five varieties. The degree of infection and the effect on these enzymes in the plants were rather variable. Total nitrogen content of bean varieties having differential resistance to Fusarium root rot was determined. The variety possessing the greatest field resistance contained the greatest amount of nitrogen. (E-fg) Wyoming Agr. Exp. Sta. 424-B

Disease Resistance in Plants. Studies on the nature of resistance in Virginia Savoy spinach to cucumber mosaic virus were completed. The resistance in Virginia Savoy is determined by a temperature balance effect on the activities of the oxidative enzyme systems in the plant. When susceptible spinach is infected, the oxidative enzymes in the cell appear to be suppressed, allowing rapid virus synthesis to occur. When resistant spinach is attacked, synthesis is suppressed. At warm temperatures, however, blocks in virus synthesis are removed, and oxidative enzyme activity increases, resulting in rapid death of virus-infected cells and eventual collapse of the plant. Upon infection of resistant plants, a new peroxidase is produced which may be responsible for the rapid death of plants at high temperatures. (E-fg) Wisc. Agr. Exp. Sta. 427-B

Effect on Zineb on Growth and Yield of Mushrooms. Zineb, a fungicide used to prevent mushroom disease known as "bubbles" can have a "chemical pruning" effect on mushrooms. Recent tests to determine this effect, using various concentrations of zineb applied at casing time, demonstrated that a thin casing layer and a heavy watering just after zineb applications, decreased the number of mushrooms harvested. The yield was not affected by the treatments. (I) Beltsville, Maryland. 429-G

Virus Diseases of Deciduous Tree Fruits and Their Control. York Imperial Apple orchards were surveyed and individual trees showing either unusually mild or severe symptoms of York Spot were marked; budwood was removed and indexed for the presence of viruses. Indexing tests were carried out in the greenhouse. The two most common viruses detected were Chlorotic Leaf Spot virus (CLSV) and a virus that causes epinasty and decline in the Spy 27 indicator variety. A small sour cherry orchard planted in 1955 has now shown virtually complete infection with the necrotic leaf spot virus. Annual spread of virus through the orchard has been followed and serological tests made which indicate that one strain predominates. (E-fg) Pennsylvania Agr. Exp. Sta. 43-B

Trunk Cankers and Root Diseases of Peach Trees. Samples of peach wood in the area of the lower trunk were taken from peach orchards in various stages of decline, located in three different parts of the State of Georgia. Root samples were also obtained in some cases. All samples were plated out on Martin's Rose Bengal agar with streptomycin. Fungi were identified to genus in most cases. Approximately one-half of the root isolates on Rose Bengal agar were Fusarium, mostly F. oxysporum. Several species of Pythium were found in the roots cultured on the special medium. Fungi isolated from the wood in trunks of declining trees included species of Diplodia, Phoma, Sphaeropsis, Cytospora, Verticillium, Fusarium, Thielavia, and Cladosporium. Bacteria were not identified, but some resembled Xanthomonas pruni. (E-fg) Georgia Agr. Exp. Sta. 431-B

Distribution of Mites that Spread Peach Mosaic Disease of Peaches. The peach mosaic vector mite was found in Madera County 25 miles farther north than previously recorded in the important northern California peach area and 160 miles north of any known infections of peach mosaic virus. (I) Riverside, California. 431-C

Three Species of Root-Lesion Nematodes (Pratylenchus brachyurus, P. zeae, and P. vulnus) Were Found Commonly on Peaches in Central Georgia. P. vulnus, which has been associated with peach decline in California, was found for the first time in Georgia. It was the only species of this genus that was constantly associated with peach decline in Georgia. A striking

correlation was found in comparison of trees with different vigor; the less vigorous trees had large populations of P. vulnus (as many as 1,000 nematodes per gram of root), while vigorously growing and apparently healthy trees had very low populations. Preliminary studies indicate that of the six proprietary nematocides evaluated for nematode control on peaches, Temik gives best nematode control and tree response the first year after treatment. These studies will be continued for at least five years. (I) Byron, Georgia.

431-F

Influence of Various Chemical Sprays on the Natural Residences of Apple Trees. Field grown Jonathan apple trees were sprayed periodically with various chemicals attempting to influence the natural flora. Such studies might aid in our knowledge of the role played by non-pathogens in controlling pathogenic organisms. Sucrose was the only treatment showing a significant increase of foliage bacteria. However, urea, lime, aluminum sulfate, potassium chloride, dextrose, citric acid and tartaric acid encouraged the build-up of yeasts. (I) Beltsville, Maryland.

433-A

Identification, Etiology, and Control of Virus Diseases of Deciduous Fruit Trees. Recent research has shown that tobacco mosaic virus (TMV) is the most prevalent latent virus in commercial apple trees. Emphasis was placed on improving the sensitivity of the biological assay for TMV. This research has resulted in an assay that is at least 1,000 times more sensitive than present techniques. Selected bean varieties are grown under specialized light and temperature conditions, heat-treated and inoculated ultrasonically with virus in ten to 20 percent ethyl alcohol with Carborundum. The leaves are incubated under about 95 percent relative humidity at 32° C. for 18 hours then placed on two percent water agar for the development of lesions. By use of a similar procedure it was possible to detect double-stranded RNA of TMV by its infectivity. New methods have been developed for the isolation and purification of double-stranded RNA and studies with the electron microscope have been carried out on this material. (E-fg) Utah Agr. Exp. Sta.

433-B

Virus Diseases of Deciduous Tree Fruits and Their Control. Evidence was obtained indicating that the spread of apple chlorotic leaf spot virus may occur through mechanical leaf or branch contact. Fruit from russet ring Golden Delicious trees propagated from a West Coast virus source developed few typical russet ring patterns. Most of the russetting, which progressed under Maine conditions, appeared to be quite generalized over the surface of the fruit and was not unlike some severe russetting problems seen in Maine orchards not presently known to be viral in nature. (E-fg) Maine Agr. Exp. Sta.

433-B

Codling Moth Diapause Studies. Codling moth diapause prevention and termination with skeletal photoperiods showed that discontinuous light supplementation at the proper time can significantly reduce diapause normally experienced at short photoperiod. (E) Washington State University. 433-C

Codling Moth Rearing Costs. Facilities were expanded to rear 8,000 moths/day on an artificial medium. Moths reared for 34 consecutive generations on this medium show no retrogression compared to stock reared on natural foods. Cost per 1,000 adults was reduced from \$5.53 (materials only) in 1965 to \$1.90 in 1966. Cost-wise, the artificial medium holds a favorable position over apples. The reared moths were sterilized and released in a 93-acre orchard test of control of the codling moth without use of insecticides. (I) Yakima, Washington. 433-C

Codling Moth Sex Attractant Isolated. The sex attractant produced by virgin female codling moths has been isolated in pure form. Investigation of its molecular structure is in progress. (I) Yakima, Washington, and Beltsville, Maryland. 433-C

Natural Enemies of Scale Insects on Citrus. A study of citrus scale insects in Israel has been yielding significant information on the biology of the parasites and predators of citrus scales. Nine species of predators and 21 species of parasites have been found associated with the California red scale, the chaff scale, the soft brown scale, the Florida wax scale, and the black scale, all injurious in the United States. Phenological and ecological data on these natural enemies have been analyzed and summarized for evaluation of their adaptability to mass rearing in the laboratory. (E) Rehovoth, Israel. 44-C

The First Successful Cultivation of a Plant-Parasitic Nematode (*Aphlenchoides sacchari*) was accomplished in an aseptic cell-free nutrient medium of modified liver extract. This success will allow many important studies in nematode physiology. (I) Rutgers University, New Brunswick, New Jersey. 44-F

Research Established That Environmental Factors Related to Season Affected Populations of the Citrus Nematodes; numbers were highest in early spring and late summer and fall, but populations tended to remain high if good soil moisture was available. Survival of nematodes was greatest in the shade of trees in irrigated soil, lowest in unirrigated exposed soil. This accounts for the low populations and no observable damage to citrus trees during the first four-years growth of young trees because the foliage does not shade and, thereby, cool the soil. The other studies, old cotton land in Arizona, was exposed to summer fallow by plowing. Bioassay indicated that under

desert conditions drying of soil in the summer reduced root-knot populations in the upper four inches of soil, and by October high level control was obtained in soil to a depth of 16 inches. (I) Phoenix, Arizona. 44-F

Epidemiology of Citrus Virus Diseases. Viruses continue to pose a threat to citrus culture. "Mild" strains of the Tristeza virus continue to spread in commercial orchards in Florida. These mild strains of the virus, even on Tristeza sensitive scion combinations of sweet orange on sour, cause no damage but they do preclude a Tristeza-free budwood program. Two separate outbreaks of the Killer strains of Tristeza virus in Florida show that great losses would occur if the efficient black citrus aphid vector should be introduced. Experimental demonstration of spread of the Exocortis virus on contaminated budding knives indicate that this virus is probably being spread on pruning tools and hedging machines. Demonstration of transmission of Psorosis in seeds of Carrizo Citrange makes it necessary to obtain seeds as well as budwood from Psorosis free trees. (I) Orlando, Florida. 441-C

Wood Necrosis Gummosis (Rio Grande Gummosis) of Citrus. Results of recently completed artificial inoculations have been substantiated by studies of the series of 40-year old grapefruit trees showing symptoms of natural infections of Rio Grande Gummosis (RGG) and those showing both RGG symptoms and psorosis virus scaly bark in Arizona. Internal rot in RGG trees was limited to about five percent of the total trunk area whereas psorosis and RGG joint infections showed decay involving 60 to 70 percent of the trunk area. Internal decay of branch wood showed a similar relationship. A fungus, Fusarium solani, not previously isolated or associated with RGG decays, has been found in relative abundance in diseased branch and trunk wood. (E-fg) Arizona Agr. Exp. Sta. 442-G

Etiology and Control of Diseases Affecting Ornamental Crops. Geranium diseases continue to be serious each spring in New Hampshire. Losses from Xanthomonas pelargoni infections, edema, and a "nutritional" disorder have reached fifty percent in some ranges. Such losses can be minimized by purchasing cuttings from cultured stock, by sanitation, and by good cultural practices. Present studies are concerned with a disorder of geranium, the cause of which has not been definitely established. Although the symptom complex resembles a virus-induced disease, studies in sand culture strongly suggest a nutritional disorder. Similar external and internal symptoms of disease were produced when boron was withheld from plants growing in sand nutrient culture. (E-fg) New Hampshire Agr. Exp. Sta. 461-A

Investigations on Root Rot Diseases of Herbaceous Ornamentals. A wilt of carnation in certain commercial greenhouses and in greenhouses at Cornell

has recently developed. The disease is apparently associated with F. roseum root and stem base infection. Isolates did not produce typical vascular infection and wilt as found in natural infections, but did invade plants through wound inoculations of the upper stem, causing distal portions to wilt and die. The fungus is apparently being disseminated on infected or infested cuttings. Research on infection of chrysanthemum roots is devoted to determination of the relation between "soil" aeration, root development and susceptibility to infection. A unique sub-irrigated soil column placed in a plant growth chamber is being used to evaluate water, air, and other factors within the soil medium, using experimental plants infested with the pathogen before or after plants are established. (E-fg) New York Agr. Exp. Sta. 461-B

Hickory Shuckworm Mating. Emanations from developing pecan foliage, phylloxera galls, and pecan nuts stimulated hickory shuckworm moths to mate. The stimulation is not a tactile response and not induced by emissions from mature pecan foliage, or pecan nut extracts. (I) Albany, Georgia. 471-C

Forests

Causal Agents of Aspen Cankers. A complex of fungi is associated with Ceratocystis cankers of aspen in the northern Rocky Mountains. Three species of Ceratocystis, in addition to C. fimbriata which had been reported to be the causal agent, have been found on the cankers. Since Ceratocystis seems to be the only genus involved, insect vectors probably explain the spotty distribution of the cankers. Ceratocystis canker, previously known only in the central Rocky Mountains and the Lake States, is now known to occur in Idaho, Nevada, and northern California. (I) Fort Collins, Colorado. 5-B

Decay and Discoloration Processes in Living Trees. Early results of investigations of the tissue changes that occur after wounding suggest that anatomical changes may account in large part for the restrictions of discolorations and decays to tissue present when the trees were wounded. The most significant changes occurred in the ray cells. In discolored tissues, altered cells contained many different types of materials indicating that discolorations probably resulted from many different processes. Related studies of the bacteria associated with discolorations were continued and representative isolates were assayed for thiamine production. All bacteria isolated to date from northern hardwoods produced this vitamin essential for growth of many decay fungi. (I) Durham, New Hampshire. 5-B

Nature of Decay in Wood. Specialized staining techniques in combination with fluorescent lighting disclose two radically new and significant facts about the nature of decay in wood. Enzymatic breakdown of the wood substance occurs in the immediate vicinity of the fungus hyphae and is not widely diffused as once supposed. The enzymes are brought into the cell wall by very small microscopic hyphae such as previously have been known only for soft-rot fungi. Both facts help elucidate the progression of fungal attack on the microstructure of wood and the nature of decay resistance.

(E) North Carolina State University.

5-B

Infection Process in Dothistroma Needle Blight. Conidia of Dothistroma pini were trapped in late spring and throughout the summer in Nebraska, but only during periods when rain fell. The conidia germinated over a temperature range of 12-28° C.; germ tubes were longest at 24° C. Germ tubes penetrated needles of both Pinus nigra and P. ponderosa through stomata. Initial infection occurred June 16-23 in 1964; May 20-27 in 1965. Disease symptoms were not evident until 4 months after initial infection.

(I) Lincoln, Nebraska.

5-B

Taxonomy of Dwarfmistletoes. The dwarfmistletoes (Arceuthobium spp.) are highly developed parasitic plants which have undergone extreme morphological reduction. As a result, these plants are not amenable to conventional taxonomic classification techniques which rely heavily on morphology. Thus pollen, host relations, phenology, geographic distribution cytology, and chromatography of shoot pigments have been studied in attempts to determine taxonomic relationships. Preliminary analyses suggest that it will be possible to develop a computerized classification of Arceuthobium. Machine runs have already revealed that some dwarfmistletoes which were thought to be related at the subspecific level should be considered as distinct species. (I) Fort Collins, Colorado.

5-B

Pine Rust Fungi Can Infect Dwarfmistletoe. While parasitizing their regular pine hosts, Cronartium comandrae and Peridermium filamentosum can also parasitize strands of dwarfmistletoe sinkers growing in the bark of western pines. This discovery suggests that the specificity of rust fungi to only certain hosts may not always be related to internal physiological interactions. (I) Logan, Utah.

5-B

Physiology of True Mistletoes. In studies of the carbohydrate metabolism of the mistletoe Dendrophthoe falcata in India it was shown that significant quantitative and qualitative differences existed between the parasite leaves and the host leaves as to carbohydrate composition. Mistletoe leaves contained a higher concentration of acid-soluble phosphate than measured in leaves of host species of Cassia, Mangifera, and Psidium. The acid-labile

phosphate constituted a much lower and the acid-stable phosphate a higher percentage in the parasite than in the host leaf in all three host species. During investigation of the activity of phosphorylase as a key enzyme in carbohydrate metabolism a powerful inhibitor of the enzyme was discovered. (E) India, P.L. 480. 5-B

Sugar Maple Mycorrhizae. A basic study of rootlet anatomy and mycorrhizal fungi of sugar maple was completed during investigations of dieback in old-growth hardwood stands in northern Michigan. A description of developmental anatomy and the factors affecting the life cycle of a hardwood mycorrhizal fungus has been published. (I) Marquette, Michigan. 5-B

Nematodes Associated with Southwestern Conifers. Of 7 species of Criconemoides found in New Mexico soils, 2 are new species. Thirty plant-parasitic nematode species representing 14 genera were found associated with marginal Pinus ponderosa and its woodland associates, P. edulis and Juniperus spp. The most widely distributed nematodes were Aphelenchoides spp., Xiphenema americanum, and Tylenchus exiguus. The most abundant were species of Helicotylenchus. Plant-parasitic nematodes were slightly more abundant in non-drought areas than in drought areas and were more abundant on Juniperus spp. than on Pinus spp. (I) Albuquerque, New Mexico. 5-B

Host Defenses Against Annosus Root Rot. Annosus root rot is threatening to become a major disease problem in the conifer forests of the West. In California, studies were conducted to determine the influence of pine root oleoresins on F. annosus. Contrary to past beliefs, resin production by pines being attacked by F. annosus is not an efficient defense mechanism. The fungus grows into heavily resined roots and can perpetuate itself for as long as 20 years, thereby creating a hazard to future forest plantations. (I) Berkeley, California. 5-B

Ecology of Fusarium Root Rot. Fusarium oxysporum, a fungus which causes a root disease of pines has been found in forest nursery soils of California. Since observations indicated its absence from and the probability of its introduction into native forest soils, the ability of the fungus to survive in forest soils was tested. Populations of F. oxysporum, when introduced into forest soils were found to die out over a 3-year period. In a related study, aqueous extracts of pine duff were found to reduce populations of Fusarium oxysporum in soils. The extracts stimulated the resting structures to germinate and then killed the germlings. This effect of the extracts on F. oxysporum may explain the absence of Fusarium from forest soils. (I) Berkeley, California. 5-B

Phytophthora Root Rot. Resistance to Phytophthora root rot of Port Orford cedar is being sought. A screening process, utilizing levels of apparent field resistance, has been set up under greenhouse conditions. Over 10,000 cuttings representing 525 clones from Port Orford cedar trees are being rooted for resistance testing in mist propagation facilities of the project. Seven Phytophthora isolates of diverse origin are being tested for pathogenicity and subsequent use as inoculum. (E-fg) Oregon State University.
5-B

Remote Sensing Detects Poria weirii Root Rot. Remote sensing techniques in the visible, near infrared and thermal infrared portions of the electromagnetic spectrum were tested with aerial sensors in an effort to distinguish healthy Douglas-fir trees from those infected by Poria weirii root rot. Thermal infrared readings on 15 test trees showed highly significant differences between healthy and diseased tree crowns (with and without visible crown symptoms). The crowns of diseased trees averaged 2° C. warmer than healthy trees. Of the three sampling periods, 8:00 a.m., Noon, and 5:00 p.m., only the 8:00 a.m. period showed significance. (I) Berkeley, California.
5-B

Infection Process in White Pine Blister Rust. The conditions necessary for eastern white pine needle infection by Cronartium ribicola have been delineated. With this knowledge, a critical study of resistance and resistance mechanisms can now be made. Needle infection through stomata has been demonstrated consistently and conclusively. Not a single instance of direct surface penetration was observed. The critical factor necessary for controlling needle infection has been found to be diurnal temperature fluctuation within a range of 40-75° F. These fluctuations induce germ tubes to penetrate between guard cells and form vesicles which give rise to infection hyphae. (E) University of Wisconsin.
5-B

Biology of Scleroderris Canker. Studies of the causal fungus, Scleroderris lagerbergii, a serious pathogen of red and jack pine in the northern Lake States, have shown that the air-borne ascospores are disseminated from May to October, with a higher level in July and August. Most of the spores are disseminated within 48 hours after a rain. Free moisture is required for release of ascospores and for germination of both ascospores and conidia. Ascospores are released over the temperature range from 0 to 29° C., with the maximum release at about 17° C. (I) St. Paul, Minnesota.
5-B

Etiology and Control of Live Oak Decline. The oak decline disease in Texas has been shown to be caused by the fungus Cephalosporium. The fungus was isolated from naturally infected trees and cultured in the laboratory. The disease was reproduced on cultivated and wild oak trees inoculated with the

pathogen. The pathogen was observed to invade only woody tissue. This fungus is suspected of producing a toxin which kills the trees. (E-fg) Texas Agr. Exp. Sta. 5-B

Pathology of the Wilt Disease of Trees in the Northeast. Spore movement studies were continued to refine techniques and to explore the influence of stem anatomy. Passage of spores through different ring-porous species was significantly greater than through various diffuse-porous woods. A correlation was established between large twigs and small trees, and small twigs and large trees. Spore movement was significantly greater in larger twigs. Inoculation-pruning studies and microfiltration studies were continued to determine the lowest size limit of spores viable in elm vessels. Studies on the electrical charge of spores in various media with varying pH showed consistently negative charges. Studies on hydrolytic enzyme production by host tissues were continued and previous data on inhibition of spore germination was confirmed; however, loss of enzyme activity after 24 hours makes this mode of antifungal activity improbable. There was less influence of the enzyme on germ tubes than on spores. (E-fg) Maine Agr. Exp. Sta. 5-B

Microscopy Studies of Oak Wilt. In research on the oak wilt disease, electron and polarized light microscopy have disclosed the following significant findings: Fungus spores are inside xylem vessels soon after inoculation, plugging vascular elements by tyloses and gums preceding foliage wilt, fungus hyphae both within and between cells and even within cell walls and tyloses as wilt develops, and, localized necrosis of cells at one end of the abscission layer in the leaf petiole just before premature activation of this layer leads to early defoliation. Red oaks die rapidly. In contrast, many white oaks persist with the fungus confined by thick-walled fibers, gum-filled xylem parenchyma, and noninfected ray parenchyma. Trunk injections with TCPA through cones or Manget capsules have delayed initial foliage wilt and also have arrested further symptom development in branch-inoculated, susceptible red oaks. Of over 2,000 northern red oaks collected, 180 seedlings have withstood trunk inoculations. (E-fg) Wisconsin Agr. Exp. Sta. 5-B

Physiological Changes Induced by Oak Wilt. In studies designed to provide a clearer understanding of the effect of the oak wilt disease on the physiology and biochemistry of the host plant, diseased and healthy Quercus macrocarpa split-embryo paired seedlings were maintained under low relative humidity and controlled temperature and light conditions. It was found that as the disease progresses transpiration decreased rapidly over a short period of time. Invertase activity was greater in diseased than in healthy oak seedlings. (I) Delaware, Ohio. 5-B

The Study of Oak Wilt Caused by *Endoconidiophora fagacearum*. Seasonal variations in disease incidence and in latent period of infection indicated that bur oaks were most susceptible to infection during May and June in northern Iowa. Maximum susceptibility coincided closely in time with maximum physiological activity of the host, as indicated by increased frequency of observed cambial mitoses and by depletion of starch reserves in the xylem. Both mechanical wounding and disease resulted in the disappearance of starch and in the deposition of gums in affected xylary parenchyma of bur oak. (E-fg) Iowa Agr. Exp. Sta. 5-B

Ecology of Wood Decay. Studies on inoculation trials with *Fomes igniarius*, the heart rot fungus of aspen trees have shown that fresh wounds are necessary for germination of the basidiospores obtained from conks on living trees. Thus the heart rot organism first becomes established in the sapwood of a living tree. Significant also is the finding that some organisms present in the host tissues can inhibit, and others stimulate, basidiospore germination. (E-fg) Univ. of Minnesota. 5-B

Nitrogen Metabolism in Wood Decay. The role of nitrogen in wood deterioration has been investigated. The hypothesis is presented that trees possess an internal recycling mechanism for conservation and reuse of nitrogen in the cytoplasm of xylary cells. It is believed that nitrogen in the dying parenchyma cells in the heartwood is retrieved for reuse elsewhere in the tree. Hydrolysates of wood contain many protein amino acids which probably contribute to susceptibility to stain and decay fungi. Nitrogen extractions suggest that enzymes are needed to modify cellulose before the nitrogen in cell walls is available to fungi. (E) N. C. State University. 5-B

Wood-rot of Alder. The life history of *Hypoxylon fuscum*, a wood rotting Ascomycete, was studied. The fungus apparently becomes established in alder wood, rapidly decaying all types of cells. Later, hyphae emerged from the wood and spread throughout the bark. Eventually, stromata are formed beneath the bark periderm, rupturing it. Finally, flask shaped fruiting bodies (perithecia) bearing mature ascospores are produced in the stroma. These spores undoubtedly serve to spread the organism to other alder trees. (E-fg) Washington Agr. Exp. Sta. 5-B

X-ray Examination of Seeds. The correlation of predicted germination from X-ray examination of seeds and actual germination is being studied. In the case of longleaf pine seed from 69 sources, this correlation was improved if the X-rayed seed was treated, prior to germination test, by an algicide. Subsequently, tests on the pine seed discovered the presence of other microorganisms potentially hindering the germination. These included 10 species of identified fungi, and one unidentified yeast. (E-fg) South Carolina Agr. Exp. Sta. 5-B

Balsam Woolly Aphid Alters Wood Structure. An abnormally large amount of ray tissue is one characteristic of wood produced in North American firs infested by the balsam woolly aphid. The presence of abnormal ray tissues is significant because it tells something of the fundamental host reaction to the aphid. An increase in ray tissue materially affects the structural quality of the wood, and rays preempt space that would otherwise be occupied by water-conducting tracheids. Investigation of three species of western true firs (grand, subalpine, and Pacific silver) showed that wood from aphid-infested trees had 35 to 73 percent more rays per square millimeter of tangential surface than normal wood. (E) Oregon State Univ. 5-C

Overstocking Favors Beetle Outbreaks. Studies of the mountain pine beetle in young ponderosa pine stands in the Northwest have shown that overstocking is commonly associated with outbreaks. The first significant infestation usually occurs when stands are 55 to 65 years old. In unmanaged stands, infestations are likely to recur at intervals of about 20 to 40 years. In relation to their abundance in the stand, dominant and co-dominant trees are more likely to be killed than are suppressed or intermediate trees. (I) Portland, Oregon. 5-C

Genetics of Bark Beetles. In genetics tests, the four possible mating combinations of the Douglas-fir beetle from coastal and interior sources all produced fertile progeny. However, the number of progeny differed significantly between crosses, and sources of trees used for the tests. Tests of populations that may be more genetically isolated, and of closely related species are proposed to determine if sterility can be induced in wild populations. (I) Moscow, Idaho. 5-C

Budworm Population Sampling Improved. Data collected in spruce budworm egg surveys in the Pacific Northwest over a four-year period were analyzed to compare trends based on two different sampling methods. One was the standard approach of comparing density of new egg masses on foliage from year to year. The second method used old egg masses found in the current year to represent the previous year's egg population. Results showed that reliable trends can be obtained with only one year's sampling, using old egg masses to represent the previous year's new egg masses. This will also reduce the cost of predicting trends. (I) Corvallis, Oregon. 5-C

Olfactory Stimuli of Douglas-fir Beetle. Olfactory stimuli were found to influence motor responses of the Douglas-fir beetle. The fresh bark of Douglas-fir exerts a positive response, fresh needles a negative response, and 1-year old bark no response. The motor response may be to the volatile organic matter emitted by the tree; i. e., the terpenes. (E-fg) University of Washington. 5-C

Attack of Inland Douglas-fir by Douglas-fir Beetle Associated with Oleoresin Composition. A study of three sources of inland Douglas-fir has shown quantitative differences in monoterpene composition present and associated with attack by the beetle. Related work with western white pine has shown that similar oleoresin differences are highly inherited. (I) Moscow, Idaho.

5-C

Nutrition. Paired fungal tubes, or mycangia, open at the base of the front legs of the female southern pine beetle and contain fungi that probably are associated with beetle nutrition. Sectioning and staining of the mycangia from emerging beetles have revealed yeast-like spores of two sizes. Both sizes were not present in the same beetle. Sectioning of young soft bodied adults has disclosed well developed mycangia, but no organisms within them. Preliminary investigation of a fluid within the mycangia indicated an antifungal characteristic. (I) Alexandria, Louisiana.

5-C

Physiology. Preliminary pharmacodynamic studies on single heart muscle cells in the cockroach, a test insect, are yielding some interesting information on the effects of various drugs, particularly bromolysergic acid diethylamide. The excised heart of Periplaneta americana reacts strongly to the presence of minute quantities of this drug, which stops heart action almost instantly. Such information may be useful not only in elucidating the physiology of insect nerve and muscle, but also in future insecticide development. (I) Durham-Raleigh, North Carolina.

5-C

Genetics of Pine Weevils. On the basis of behavior, Pissodes strobi and P. approximatus that infest white pine, appear to be distinct species. Yet they cannot be readily separated morphologically by conventional taxonomic methods. Hybridization studies so far suggest there is no absolute sexual isolating mechanisms. Apparently other factors such as seasonal or habitat isolation, hybrid vitality and/or sterility, or some other factors must be operating under natural conditions to prevent free intermix of these two species. P. nemorensis is also considered a valid species and distinct from P. strobi and P. approximatus. Positive identification is absolutely essential for successful control of any pest species. Lacking this, control can be both ineffective and wasteful. (I) New Haven, Connecticut.

5-C

Remote Sensing Improves Insect and Disease Detection. Significant progress was made in each of the following areas of research for which the usefulness of aerial photography and other remote sensing imagery is being investigated: (1) the development of image specifications for the detection of insect and disease attacks on forest trees; (2) the aerial photo identification of commercially important tree species; and (3) the inventory of forage, livestock, water, soil and recreational resources of wildland areas by means of multi-

spectral remote sensing. Multispectral sensing techniques showed that beetle-infested, dying ponderosa pine trees are (1) warmer by 2 to 7 degrees C. than healthy trees, (2) change color with rate of blue stain development and number of developing beetles, and (3) transpire at a reduced rate. (I) Berkeley, California. 5-C

Masking of Sex Attractant Effect. Masking of the effect of the sex attractant of the oak silk worm by substances in the abdomen of the female moths has been demonstrated. A similar masking action was previously found in cynthia moths. (I) Beltsville, Maryland. 5-C

Tuliptree Scale Protected by Ants. The ant Dolichoderus taschenbergi, which feeds on honeydew excretions of the tuliptree scale, has been found suppressing the natural enemies of the scale in the Northeast. Ants from one nest will forage a territory of about 0.6 of an acre. There are as many as 30 ant nests in a 24-acre old field site. The activities of this species of ant are confined to open sites; such sites remain open longer than non-infested sites due to the protection of the scale which suppresses yellow-poplar regeneration. (I) Delaware, Ohio. 5-C

Spruce Budworm Diet. A method has been developed in California for rearing western spruce budworm on an artificial diet. It largely follows the procedures used in Canada to rear the eastern form of the budworm. Mating success, fecundity, and larval and pupal survival are similar to those obtained in Canada. Some cultures are in the fourth generation and there has been no apparent effect on vitality. About 3,000 larvae are being reared weekly with this method. (I) Berkeley, California. 5-C

Tussock Moth Sampling Improved. Studies in 1966 in the Pacific Northwest revealed that Douglas-fir tussock moth populations can be reliably estimated by sampling branches. For equivalent precision a much larger sample is needed for eggs than for larvae. Larvae are not uniformly distributed over the tree but the middle crown appears to be representative of the whole tree. Sequential sampling plans for both eggs and larvae were prepared in 1966 which will be adequate for general classification of population size or trend. (I) Portland, Oregon. 5-C

Weather Reduces Needleminer Populations. Lodgepole needleminer studies were conducted in California to determine the cause of the recent sharp decline in the needleminer population, the current status of the population, and the impact of the miner on the host. The sharp decline was associated with adverse weather when the new generation of insects was getting established in midsummer. At the reduced population level, mortality caused by eulophids, primary parasites of leaf miners, is proportionately higher than

in the epidemic population. Impact, as measured by tree mortality and by reduction in foliage, shoot, and annual ring growth, is most severe in older trees. Death of a tree often follows when annual ring width falls below 0.4 mm. However, surviving trees recover rapidly when released from the infestation by spray or by natural population decline. (I) Berkeley, California.

5-C

Resistance of Woody Plants to 2,4-D. This project at Auburn University focuses on the activity of basic cellular directive substances, RNA, or ribonucleic acid. The objective is to correlate changes in RNA levels in treated leaves and the activity of the associated enzyme ribonuclease with resistance of woody plants to the herbicide 2,4-D. Work is in progress with red maple, sweetgum, and yellow-poplar. (E-fg) Auburn University.

5-D

TARGET II

TO IMPROVE AND DEVELOP MEANS OF CONTROLLING PESTS BY NON-PESTICIDAL METHODS

General

Breeding Stock Introductions. International plant exchange resulted in 7,581 acquisitions, many of which are being evaluated for insect and disease resistance by Federal, State, and private plant breeders. (I) Beltsville, Maryland.

1-A

Verticillium Wilt Infection under Different Tillage Systems. With optimum tillage there was twice as much wilt, 41 percent more plant growth, but no difference in yield compared to normal tillage. Optimum tillage consisted of root and stalk shredding, rebedding on the same plant row, nematocide application, bed cultivation after preirrigation and planting. Normal tillage consisted of stalk shredding, disk harrowing twice, tillage with a rototiller, disk harrowing, bedding, nematocide after preirrigation, bed cultivation and planting. (E-fg) California Agr. Exp. Sta.

1-B

Cell Wall Composition and the Microbiological Lysis of Soil Fungi. Melanin-like pigments appeared to confer protection against lysis in the soil, to cell wall structures of many soil-borne pathogenic fungi. The vegetative hyphal walls of Aspergillus phoenicis and Sclerotium rolfsii contain large amounts of glucose- and N-acetylhexosamine-containing polysaccharides. The walls are extensively digested by Streptomyces culture filtrates or by a mixture of purified chitinase and B-1, 3-glucanase preparations with the release of monomeric units. Microorganisms decomposing hyphal walls of S. rolfsii did not attack the melanin-colored sclerotia produced by this fungus. No microorganism was found capable of lysing the fungi Rhizoctonia solani and a Cladosporium spp. which produce hyphae containing abundant melanin. Polyphenoloxidase activity in the vegetative hyphae of A. phoenicis and S. rolfsii is inhibited by the presence of a dialyzable factor. (E-fg) Kentucky Agr. Exp. Sta.

1-B

Biology and Control of Nematode and Bacterial Diseases of Crops. Soil temperature tests indicate that early planting of sugar beets should not be favorable for infection and reproduction by the nematode Nacobbus batatiformis; very little infection occurs at 10° and 15° C. Cercospora beticola survives well in sugar beet straw maintained on a soil surface but not when buried to a six-inch depth; plowing of beet residues should decrease primary inoculum. Survival of bean wilt and blight bacteria is favored when infested straw is maintained on the soil surface; control by burial or of plowing or of proper disposition of bean straw is suggested. Systemic bactericides applied to bean seed or soil were ineffective in inhibiting halo or common blight bacterial infections. Over 100 sugar beet selections tested for their reaction to crown rot by toothpick and soil inoculations were susceptible, indicating difficulty in obtaining resistance to the disease. (E-fg) Nebraska Agr. Exp. Sta.

1-B

Crop Residues and Root Diseases. Antagonism to the growth of Fusarium solani f. phaseoli by Chaetomium spp. appeared to be related to differential utilization of nutrients and not specifically to antibiotic production. Growth of Chaetomium in shake culture depleted cellular nutrients and synthesized metabolites utilized poorly by Fusarium; the utilization of nitrate nitrogen was very sparse, and a major factor in this result. In "live" soil experiments evaluating both plant residues and nitrogen nutrition, the following results were obtained: (a) Better chlamidospore germination and greater incidence of successful infections with nitrate than with ammonia or amino nitrogen; (b) strongest disease suppression by barley straw when no nitrogen source was added; (c) greatest antagonism by Chaetomium when nitrate nitrogen was supplied; and (d) lowest disease in the barley-Chaetomium treatment when no nitrogen supplement was added. (E-fg) New Mexico Agr. Exp. Sta.

1-B

Biological Control of Diseases on the Aerial Parts of Plants. Basic investigations of the ecology of non-pathogenic bacterial epiphytes were conducted. Some bacteria, known as bacterial residents, are capable of multiplying and migrating up the seedlings following application of the cultures to seed, provided the emerging seedling is kept at a high relative humidity. Additional studies have shown that two marker bacterial residents (pigmented in culture) isolated from cucumber plants migrated from the seed to the seedling of corn and soybean plants. Results from field and laboratory studies suggest that bacterial residents grow most quickly in free water, and that only very hardy ones will be found consistently under alternating wet and dry conditions. Studies were continued on the interactions of bacterial epiphytes and the fungal pathogen Colletotrichum lagenarium on cucumber seedlings. Although many bacterial isolates have been tested, germination of the fungal conidia has not been inhibited. (E-fg) Ohio Agr. Exp. Sta.

1-B

Natural Enemies of Rust Fungi in the Tropics. Fungi and insects were found recently to destroy many rust fungi in Dominica, B.W.I. The fungus genus Darluca was abundant on rusts of grasses. Tuberculina was very common on rusts of herbs and shrubs. Several other as yet unidentified fungi also destroyed rusts. Insect larvae (mostly of Diptera) and mites were invariably present feeding upon rust spores. Some mites transported great loads of spores to their nests and contributed to the spread of the rust pathogens. Other insects ate host plant and rust, often destroying the lesions before the rust could sporulate. These same types of enemies have been encountered in the United States but are more destructive in Dominica. Darluca and Tuberculina seemed particularly destructive of rusts and may offer some potential as biological agents in their control. (I) Beltsville, Maryland.

1-B

Control of Mites with Bacillus thuringiensis. Studies were initiated to determine the effect of some of the commercial Bacillus thuringiensis materials against mites. A bacillus "fly control material" when sprayed on leaf discs bearing Panonychus citri and Tetranychus pacificus, produced 70 to 75 percent mortality at a 0.1 percent dilution, with death occurring within 3 days. An exotoxin from this material sprayed at a 1 percent dilution caused 98 percent mortality to P. citri. (E-fg) California Agr. Exp. Sta.

1-C

Effect of Electromagnetic Radiation on Insects. Periplaneta americana were exposed to lights of different wavelengths for different time periods. Cockroach responses were significantly different. Fluorescent germicidal light was significantly more effective than other lights and red was significantly less effective than other lights. Longer time periods were more effective than 10 minute periods. (E-fg) Massachusetts Agr. Exp. Sta.

1-C

Importation of Insect Parasites. Twenty-one species of parasites and predators of eight kinds of insect pests were collected in Europe for introduction into the United States for testing, evaluation, and actual use in biological control. All of these beneficial insects, approximately 25,000 specimens in 100 shipments, were received for screening and transshipment to liberation points or to various Federal and State field stations for evaluation. A total of 251 shipments (almost 62,000 specimens) was made available to State or Federal laboratories in 29 States. (I) Moorestown, New Jersey.

1-C

Attractant for Yellow Jackets. Certain esters of alpha-beta-unsaturated acids were found to be effective attractants for yellow jackets. They are highly specific, attracting no beneficial insects such as honey bees. Radiophosphorus-labeled yellow jackets were collected as far as 3,000 feet from their nests with one of these, 2,4-hexadienyl butyrate. This lure may be useful in protecting outdoor working and recreational areas from yellow jackets. (I) Beltsville, Maryland, and Corvallis, Oregon.

1-C

Further Gains Made in Research with Chemosterilants for House Flies. Of 1,004 chemicals screened for chemosterilant activity, 80 caused complete sterility in adult house flies. Permitting emerging flies to crawl through chemosterilant-treated styrofoam pieces produced high sterility. Chemosterilants applied to abdomens of female flies caused sterility in males also. (I) Gainesville, Florida. 1-C

Imported Cabbageworm Parasites. Two Pieris-reared strains of Trichogramma evanescens, one from Poland and one from France, parasitized nearly 100 percent of a laboratory cabbageworm culture in recent tests. Six days after approximately 2,000 eggs parasitized by the Polish stock were released on wild mustard plants in the field, 11 percent of the cabbageworm egg population was parasitized, a much higher portion than is to be expected from native parasites alone. Further experiments with these promising insects are underway. (I) Columbia, Missouri. 1-C

Cabbage Butterfly Parasite. Apanteles rubecula, a hymenopterous parasite of the cabbage butterfly, is a European and northern Asian species which is quite host-specific. As it was accidentally introduced into, and had become established in, British Columbia several years ago, it was field collected there for laboratory studies, rearing, and release in the United States. As the result of a small-scale rearing program initiated to maintain the species, almost 600 adults have been released in the field in Missouri. Close observation will determine how well this species may become established in that State. (I) Columbia, Missouri. 1-C

White-fringed Beetle Treatment. Balled and burlapped and potted nursery stock treated with DD-136 nematodes produced some mortality of white-fringed beetle larvae but complete control was not achieved. (I) Gulfport, Mississippi. 1-C

Bacteria Fermentation Product Kills Mosquitoes. A fermentation product of Bacillus thuringiensis was toxic to larvae of Culex tarsalis, with an LC-90 of about 40 ppm during larval development. Toxicity was expressed as failure of the mosquitoes to survive and emerge as adults. (I) Corvallis, Oregon. 1-C

Many Pathogens Attack Mosquitoes. Protozoan pathogens have been found in 17 species of mosquitoes, a bacterium in 3 species, fungi in 9 species, nematodes in 6 species, and at least 2 species of virus in 4 species of mosquitoes. One virus has been maintained in the laboratory through 62 successive generations of mosquitoes. (I) Lake Charles, Louisiana. 1-C

Green Peach Aphid Predator. Antocoris melanocerus was effective in the control of the green peach aphid on broccoli and sugarbeets. Females deposited 3 eggs per day for 50 or more days and multiplied approximately 48 times in a single generation. Yakima, Washington. 1-C

Cabbage Looper Parasite. Voria ruralis is the most prevalent parasite of cabbage looper larvae on various host plants in Arizona. Peak parasitism occurred during the period of October to December when 50 percent or more of the larvae collected were Voria parasitized. (I) Mesa, Arizona. 1-C

Phenethyl Butyrate Attracts Japanese Beetles. Phenethyl butyrate has been found superior to materials that have been used up to now as attractants for trapping Japanese beetles. It also is more specific, attracting less bees to the traps. (I) Beltsville, Maryland. 1-C

New Pathogen Found in a Stored-Product Insect. The morphology and developmental cycle were described for a previously unknown species of Nosema from the Indian-meal moth. The pathogen was found to invade a variety of tissues and organs. Larvae were readily infected perorally and those with acute infections usually died before pupating. The pathogen invaded developing eggs. Adults harboring latent infections transmitted the pathogen through eggs. Tests with other species of stored-product insects indicate a limited host specificity. A manuscript describing the new species of pathogen and the related findings has been sent to a journal for publication. (I) Fresno, California. 1-C

Physiological Control. An interesting finding in studies with Dermestes maculatus in Israel is that the most effective antimetabolites tested thus far are antagonists of biotin and folic acid, which are required by the insect in extremely smaller amounts than the remaining B-vitamins. Larvae and adults were not adversely affected by excessive doses of B-vitamins, except that overdoses of biotin caused sterility in adult females. Some of the antimetabolites greatly extended the period of insect development. Since reducing the number of annual generations could have practical ecological significance, further attention will be given to effects of substances on fertility and fecundity. Juvenile hormonelike compounds, precursors and analogues of farnesol, also caused remarkable prolongation of the larval period, considerable larval mortality, and greatly delayed pupation. (P.L. 480) Hebrew University, Jerusalem, Israel. 1-C

Electron Microscope Studies. Examination of the antenna of the Indian-meal moth revealed details of structure and organization of several sensory receptors previously undescribed. Light and electron microscope studies of the antenna of the saw-toothed grain beetle larva revealed a complex receptor

structure on the terminal segment. This may be a hygroreceptor. Preliminary studies on adults of the black carpet beetle indicate that a large ocellus on the head may have an important relationship to phototropic behavior. Preliminary investigations of the sex-attractant gland of the Indian-meal moth indicate it is similar to that organ studied in other species.

(I) Savannah, Georgia.

1-C

Effect of Controlled Atmospheres on Insects. Laboratory tests with nitrogen purging of a simulated storage facility showed that oxygen must be reduced to 2 percent or less to kill insects in a reasonable time. With carbon dioxide purging, highly effective results were obtained with most insects when oxygen was decreased to 13 percent or less and carbon dioxide increased to 43 percent or more. For effective results against larvae of the dermestid beetle, Trogoderma glabrum, it was necessary to reduce the oxygen to 7 percent or less and raise the carbon dioxide to 60 percent or more with exposures of less than 14 days. (I) Savannah, Georgia.

1-C

Symbionts in Stored-Product Insects. In a detailed anatomical and histological study of the alimentary canal of the carpet beetle Attagenus megatoma, ninety percent of the larvae examined were found to contain intestinal protozoans of the family Actinocephalidae. They are reported to be nonpathogenic but this point is not certain. Their association with the insect is receiving further attention. Preliminary studies were made on the isolation and identification of other microorganisms associated with several species of dermestids, the Indian-meal moth, and the cigarette beetle. Antimicrobial feeding studies were conducted to develop aposymbiotic individuals and populations. Significant decreases in weight were noted in some tests where sorbic acid was used. (E) University of Wisconsin.

1-C

Mite Colony Recovery from Gamma Irradiation. Colonies of Acarus siro irradiated at 10 and 15 krads could not be distinguished from controls on the basis of age classes of the various stages after the first 6 weeks. No new young were observed in any colony during the first 6 weeks after irradiation with 20 krads or more. Larvae were again found in colonies 6 weeks after irradiation at 50 krads, the highest level for which tests are completed. Colony recovery was so rapid that the age class distribution was again normal by the end of the 9th week for doses as high as 30 krads. Such recoveries are considered at this time to result from incomplete sterilization of the mites at doses through 50 krads. It is possible that the irradiation causes temporary sterility by damaging the later stages of spermatogenesis. This theory remains to be investigated. (E) University of Georgia.

1-C

Meal Moth Sex Attractant. Bioassays with extracts of different ages of larvae and pupae of the Indian-meal moth showed there was production of a sex attractant in trace amounts by female pupae 1 day before emerging as adults. There was high production by adult females from 1 hour to 5 days after emergence. Males that survived gamma irradiation were as responsive as untreated males to the attractant of the female. Females irradiated with 50 krads produced a pheromone still attractive to males. Wind tunnel tests with the attractant showed that physical contact of the attractant molecules with receptors on the male is necessary to evoke a behavioral response. Males responded only when the attractant was placed upwind, but as far as 15 feet. (E) University of Georgia. 1-C

Pathogens in Stored-Product Insects. The use of biological control measures to protect stored products has received relatively little attention until new studies were initiated this year. Many species of protozoan pathogens have been found in stored-product insects from laboratory cultures and field collections. Most have not been reported previously from these insects and represent undescribed species. A granulosis virus was isolated from two laboratory cultures of the Indian-meal moth. Several field populations of this moth were found infected with Bacillus thuringiensis. All pathogens found were readily transmitted perorally. All but one were highly pathogenic. Larvae that acquired acute infections died before pupating. (I) Fresno, California. 1-C

Predator of Insect Eggs. A psocid as yet unidentified was found to cause high mortality of the Indian-meal moth in a laboratory room at Fresno. It consumed eggs and fed some on dead larvae but live first instar larvae were not eaten. (I) Fresno, California. 1-C

Effect of Sound on Insects. Indian-meal moths were confined in quart Mason jars or plastic dishes with culture media and exposed to a variety of frequencies, intensities, and types of sound. No significant difference occurred in the number of F₁ generation individuals produced between those exposed to these sounds and those not so exposed. Observations were made on the behavior of adults of a number of stored-product insect species exposed to random noise and various frequencies and intensities of sound in an attempt to determine whether the insects could hear or detect sounds. Some increased activity and movements of legs and antennae of the black carpet beetle were occasionally noted, but the response was not consistent. There was no evidence to prove the insects were actually "hearing". (I) Savannah, Georgia. 1-C

Exposing Adult Indian-Meal Moths to Sounds of 200, 2,000, 10,000 or 20,000 Hz had no consistent effect on the number of matings, number of eggs retained by the female, or sex ratio in the F_1 generation. There was, however, an average reduction of 22.7 percent (range 8.5 to 39.5 percent) in the number of F_1 progeny from moths exposed to the 200-Hz sound. Moths 1 day old exposed for 4 subsequent days to sound of 10,000 Hz laid 41 percent fewer eggs than did unexposed adults. When young pupae were exposed to sound at 2,000 Hz for 5 days, and the resulting moths reared in jars, there was a 27 percent reduction in progeny from treated insects. None of the frequencies influenced the ability of the moths to select an oviposition site in the food media and they did not select locations with either high or low intensity sound. (E) University of Georgia. 1-C

Carbon Dioxide Poisoning. Preliminary work indicates that an insect's susceptibility to carbon dioxide poisoning may be in relation to its rate of respiration. Indian-meal moth larvae consume oxygen at a much greater rate than do larvae of Trogoderma glabrum and are much more susceptible to carbon dioxide poisoning. (I) Savannah, Georgia. 1-C

Biology of Microsporidian Disease of Armyworm. Nosema necatrix, a microsporidian disease of the true armyworm, infects by extruding a polar filament which pierces the gut wall, allowing the spore to enter and multiply in the fatty tissue of the insect's abdomen. The insect does not die quickly, but our research has demonstrated that bacteria can enter the body cavity through the gut wall along with the protozoan, causing rapid death from bacterial septicemia. Various species of bacteria are being fed in combination with microsporidian spores for potentiation of the pathogen. (E-fg) Illinois Agr. Exp. Sta. 1-C

Production of Sound by Insects. No sounds of biological importance were detected from immature or adult stages of 10 species of stored-product insects. Environmental factors were altered and physical or chemical stresses were applied in an attempt to elicit sound production. Wing flutter sounds were detected and recorded from 5 species, but caused no response when played back to the insects. Sounds from movement or feeding were explored as possible detection or inspection methods. Rice weevil larvae feeding inside kernels of wheat and red flour beetles moving about in flour were easily detected in an anechoic chamber but not in competition with general background noise of the laboratory. (I) Savannah, Georgia. 1-C

No sounds at the 1 kHz level or in the 15 to 60 kHz range, other than those from normal insect movement, were detected among colonies of the confused flour beetle or the merchant grain beetle. No stress sounds resulting from pinching, squeezing, or scratching, and no mating sounds could be detected from the confused flour beetle. (E) University of Florida. 1-C

Gamma-Ray Effect on Mites. Eggs were obtained from the mite Acarus siro after irradiation as eggs, larvae, protonymphs, and tritonymphs at 50, 40, 35, and 30 krads, respectively. This is a reversal of the results with insects where resistance to radiation increases rather than decreases through successive stages of development. When small colonies of this mite were irradiated, egg production continued at all dosages through 50 krads. There was an increase in egg production at 10 and 15 krads, then a distinct decrease above that dosage in comparison with untreated controls. Egg hatch decreased with each increase in dose for about the first 4 weeks after treatment.

(E) University of Georgia.

1-C

Juvenile Hormone-Mimicking Compound. Farnesyl methyl ether was tested in topical applications against larvae and pupae of 6 species of stored-product insects and gave less than 50 percent mortality in concentrations up to 5,000 ppm. There was high mortality when larvae of the cigarette beetle and the confused flour beetle were placed on diets containing 40 ppm of the compound, but 20 ppm was much less effective. (I) Savannah, Georgia.

1-C

Physical Resistance of Packages to Insects. A polypropylene overwrap on shell cartons gave excellent protection against infestation. Two major food firms have begun the use of such films based on these findings. Polypropylene packets are much more resistant than those now used for spaghetti and pizza mix. Fibrous, spunbonded polyethylene resisted insect penetration in preliminary tests. (I) Savannah, Georgia.

1-C

Improved Carton Closure. A new system sandwiches an adhesive in carton flaps. Slits in the inner ply allow adhesive to flow out and form a heat seal. This gave excellent protection against insect invasion in preliminary tests. (I) Savannah, Georgia.

1-C

Insects to Control Tansy Ragwort. A second release near Fort Bragg, California, of Hylemyia seneciella, the ragwort seed fly, was made during 1966. A previous infestation from a 1965 release in a slightly different location died out. Releasing females of all ages resulted in a much heavier infestation than the previous year, almost six times as many larvae having been found in the heads of tansy ragwort in the area almost 3 months after the release date. (I) Albany, California.

1-D

Insects on Alligatorweed. Four shipments comprising 8,000 alligatorweed thrips from Argentina were received for quarantine and processing prior to release. Culture units were set up to propagate an F_1 generation, which is now nearly large enough to make releases possible in the near future. Alligatorweed flea beetles have been distributed to 11 localities in 5 States, and these areas, together with those previously infested, are being surveyed

intensively to evaluate the success of this method of weed control.

(I) Albany, California.

1-D

Complete Control of All Nematodes in Vegetable Transplant Seedbeds is Desirable, and Required by Regulation in Some States. Studies in Georgia Have Shown that Rotations of Crotalaria, Marigolds, and Hairy Indigo, Coastal Bermuda and Pensacola Bahia Grasses, and Summer Fallow, Greatly Reduce Many Types of Plant-Parasitic Nematodes - but not completely. Close to 100 percent nematode control on vegetable transplants has been obtained by applying two organophosphate nematocides after rotations but before the susceptible vegetable transplants are grown. Two halogenated hydrocarbon and one isothiocyanate soil fumigants were not so effective when used in rotation schemes. Also, nematodes were greatly reduced if there was a 2-month fallow between removal of vegetable transplants and sowing of cover crops. Small grains are frequently grown in rotation with major cash crops in many areas, but the effect of grains on nematode populations is poorly understood. Studies at Tifton, Georgia, indicate that oats, wheat, and rye all supported root-lesion nematodes (*P. brachyurus*) but least numbers developed on rye. Peanuts grown after rye or fallow were least affected by these nematodes. (I) Tifton, Georgia.

1-F

Research Indicates that Additions of the Predaceous Nematode, Monchoides sp., to Soil Does Not Control Plant-Parasitic Nematodes. In other studies additions of 4-8 tons per acre of alfalfa meal controlled plant-parasitic nematodes, but had little effect on other nematodes; there was a sharp increase in numbers of zymogenous soil fungi and bacteria until the organic substrate was depleted. (E) University of Florida.

1-F

Control of Nematodes by Rotation and Use of Resistant Varieties. Sod-base rotations revealed that some plants suppress one nematode species but favor others. Fescue and Coastal bermudagrass suppress root-lesion nematodes but greatly increase sting, stubby-root, and dagger nematodes. On newly cleared, virgin land, large populations of sting, root-lesion, and stubby-root nematodes developed after two years of Coastal bermudagrass, millet and sudangrass. Damaging numbers of nematodes did not develop on virgin land cultivated to Crotalaria and Hairy Indigo. Field evaluations in Louisiana established that the root-knot susceptible sweetpotato (Goldrush) is resistant to the reniform nematode, and all root-knot resistant sweetpotato varieties are susceptible to the reniform nematode. Studies of susceptibility of soybean varieties to root-lesion nematodes showed that factors for resistance to the soybean-cyst nematode in 'Peking' do not impart similar resistance to root-lesion nematodes. Therefore, both the plant breeder and the agronomist will have to combine resistance to more than one nematode for control of nematode problems on a given crop. (I) Tifton, Georgia.

1-F

Factors Influencing Survival and Pathogenicity of Plant Parasitic Nematodes. Summer cover crops of marigold, Crotolaria and Hairy indigo sufficiently suppressed populations of Belonolaimus longicaudatus and Criconemoides sp. to promote excellent production of tomato plants. Coastal Bermudagrass, beggar weed, and millet favored development of B. longicaudatus to the extent that percentages of marketable tomato plants from the subsequent crop were markedly reduced. Combination treatment of two-month fallow followed by cover crop suppressed nematode population more than did other treatments alone. Three-year rotation of peanuts, cotton, and corn suppressed development of B. longicaudatus due to the inability of the nematode to reproduce on peanuts. New land which supported initially small populations of plant parasitic nematodes showed significant increases in populations of Trichodorus sp. and Pratylenchus sp. after three summers of growth of millet, sudangrass, Coastal Bermudagrass and cotton. (E-fg) Georgia Agr. Exp. Sta. 1-F

A Soil Flatworm Predaceous on Nematodes. In recent studies directed toward biological control, another enemy of plant-parasitic nematodes was discovered--a soil flatworm. This flatworm was found ingesting larvae of root-knot nematodes, pests that attack and damage many crop plants. Only 1/50 of an inch long, the flatworm must ingest many nematodes to complete its life cycle. The egg, about 1/100 of an inch in diameter, is laid singly and hatches into a young individual which again feeds on nematodes. In one laboratory test, each flatworm consumed an average of 3.5 larvae per hour. The potential of this flatworm as a possible biological control agent requires further investigations, especially its role and relationships in the soil. Since this flatworm is now recognized as one of the many known enemies of nematodes in the soil, perhaps it and other predaceous organisms can in time be effectively manipulated to achieve significant biological control of many plant-parasitic nematodes. (I) Beltsville, Maryland. 1-F

Animals

Face Fly Biology and Biological Control. Prior to July 15, 1966, face fly populations at Lincoln, Nebraska, were three flies or less per animal, but increased to 10 or more per animal and remained high. Flies began to congregate at overwintering sites in mid-September. Fly larvae migrated from 0.5 to 30 feet from the cow dung in which they bred before pupation; the distance depended on ground cover and other factors. Aleochara tristis larvae, parasitic on face flies, traveled 12 to 14 feet to parasitize face fly pupae. (I) Lincoln, Nebraska. 21-C

Beetle Response to Light. Adult black carpet beetles gave a maximum negative response to light at the age of 1 to 3 days. After 5 days of age the negative response decreased sharply and at 8 days of age there was a slight positive response. With further increase in age the beetles were rather indifferent in response to light. There was little difference in response as a result of sex, whether mated or not, or of various rearing conditions. (E) University of Georgia. 21-C

Another Insect Pheromone Synthesized. The sex-attractant produced by female black carpet beetles, Attagenus megatoma (formerly called piceus) has been isolated, identified, and synthesized. The compound is trans-3, -cis-5-tetradecadienoic acid. Male beetles respond to the synthetic product in the same manner as they do to the females. A trap to be used with the attractant has been built and tested successfully in the laboratory. Large numbers of female Trogoderma inclusum and T. glabrum have been isolated and their sex-attractants are receiving preliminary study. (E) Stanford Research Institute. 21-C

Sanitation Procedures Alone Can Give 33 Percent Fly Control. Sanitary measures at a single farm resulted in marked reduction of house flies even though unsanitary farms were as close as one-half mile away. When flies were released at this farm, they dispersed primarily upwind and towards potential breeding sites, rather than to clean areas. (I) Beltsville, Maryland. 21-C

Social Parasite of the Imported Fire Ant. Progress was made in overcoming the resistance of the imported fire ant to artificial infestation with Labauchena daguerri. (E) Montevideo, Uruguay. 21-C

Biological Control of Face Fly. Field mortality studies of the face fly showed that there is a consistently high mortality of eggs and larvae (90-100 percent) in central Missouri throughout the season which can be attributed to parasites and predators. An imported aleocharine parasite of the face fly was received from northern France (through USDA laboratories) for study prior to possible release in the State. It was found that for maximum parasitism by Aleochara tristis the host puparia should be not over 48 hours old. The beetle larvae were found to be most successful in parasitizing the face fly puparia when the host was allowed to pupate in soil. Seventy percent of the beetle larvae that were successful in parasitization found the puparia and entered during the first 12 hours. (E-fg) Missouri Agr. Exp. Sta. 21-C

Culture Temperature and Age Effect Nematode Larvae. The effect of culture temperature and age on the infectivity of the larvae of Trichostrongylus axei and T. colubriformis in rabbits and guinea pigs was investigated. The in-

fectivity of T. axei in rabbits was significantly higher when the larvae were cultured at 10 C. for 29 days then at 25 C. or 32 C. for 9 days. However, more T. colubriformis worms were recovered from rabbits infected with larvae cultured at 25 C. than from those infected with larvae cultured at 10 or 32 C. Infectivity was reduced when T. colubriformis larvae were maintained for 21 days at 25 and 32 C. Female rabbits were more susceptible to T. axei than the males, but the latter were more susceptible than the females to T. colubriformis. (I) Experiment, Georgia. 21-E

Biological Control of Psorergatic acariasis. Despite continual association between 8 mature ewes infested with Psorergates ovis, the Australian itch mite, and 36 uninfested ewes and lambs, the infestation has apparently died out on all but two of the originally infested ewes, and has not spread to any of the uninfested ewes or lambs after 1 year. Transfers of Ps. bos from infested to clean cattle have not taken place even though one infested bull, kept in continuous contact with clean cattle for 18 months, was extremely heavily infested. Spontaneous but gradual disinfestation of the bull was complete after about 2 years. These observations suggest that prompt and rigorous treatment of herds found to harbor Ps. bos may be premature and ultimately unnecessary. (I) Albuquerque, New Mexico. 21-E

Rate of Infection Affects Establishment of Some Parasites in Cattle. The ratio of infections established in calves given single doses of larvae of gastrointestinal nematodes to those given equivalent total doses at increasing and decreasing dose rates indicated that the development of resistance to infection by the calves subjected to multiple doses of larvae was greater than that of the calf given a single dose. However, the average daily loss of worms after the first or single exposure was comparable in all 12 experimental calves. Resistance in similarly infected calves did not develop against the lesser stomach worm, Ostertagia ostertagi, to the same extent that it developed against the intestinal worm, Cooperia oncophora. (I) Beltsville, Maryland. 21-E

Increasing Stocking Rate of Cattle Increased Nematode Parasites. Increasing the stocking rate of cattle on a pasture increased the number of worms recovered at necropsy, and this increase in worms reduced the performance of the steers, as viewed by the weight gains and slaughter and carcass grades. (I) Experiment, Georgia. 21-E

Face Fly Control. Bacillus thuringiensis added to cattle feed rendered cow manure unsuitable for face fly development. Face fly eggs laid in the treated manure fail to develop to egg-laying adults. The use of a feed additive for fly control is convenient, time saving, and free from the hazards inherent in the application of most insecticides. (E-fg) Pennsylvania Agr. Exp. Sta. 22-C

Mite Attractant from Cheese. An attractant for the cheese mite has been separated from cheddar cheese by steam distillation. It can then be extracted from the distillate with ether and is found in the neutral fraction of the ether extract. (P.L. 480) Tokyo University of Agriculture, Japan. 23-C

Ecological Study of the Regulation of Insect Numbers in A Community. The density and spatial relationship between the wasp parasite, Nasonia vitripennis, and housefly host, Musca domestica, were investigated. As parasite dispersion decreased in a defined space, parasitism increased from 30 to 70 percent and host survival decreased from an average of 65.0 to 18.9 percent. The number of host pupae producing parasite progeny and the survival of host pupae decreased as the proportion of small host pupae increased. (E-fg) New York City Agr. Exp. Sta. 23-C

Controlling Flies Without Chemicals. Previous findings were confirmed that fly population reductions of one-third can be achieved by sanitary means even when unsanitary farms are as close as one-half mile. Flies disperse primarily upwind and to "dirty" areas with many possible breeding sites. Both lighted and unlighted electrocutor grids were virtually ineffective outdoors in cattle pens. Three types of attractant-toxicant devices tested inside barns killed slightly more flies. Electromagnetic radiation tests indicate no benefits from cycling. At low temperatures (65° F.) the catch of flies is predominantly males with longer waves--green, yellow and orange--more attractive than ultraviolet. At 90° the catch is predominantly females with short wave lengths being most attractive. (I) Beltsville, Maryland. 23-C

Chemically-induced Sterility Better than Radiation-induced Sterility in Culex p. quinquefasciatus. Irradiation made males sexually sterile, but reduced their competitiveness with normal males. Males sterilized with the chemosterilant apholate were equally competitive with normal males in mating with untreated females. Dusts containing only 0.5 percent of tepa gave 100 percent sterility, while undiluted apholate was needed to produce the same results. (I) Gainesville, Florida. 24-C

Pathogen Controls Poultry Lice on Chickens. A commercial preparation of Bacillus thuringiensis containing spores, crystals, and toxins gave complete control of lice on leghorn hens. (I) Kerrville, Texas. 24-C

Biological Control of Blackhead of Poultry. In biological control work, turkeys were more susceptible to the causal agent of blackhead and to the disease than were chickens and other birds. In chickens, decreasing susceptibility was found in the New Hampshire Red, Barred Plymouth Rock, and White Leghorn breeds. Some resistance to the cecal worm, the vector of the blackhead parasite, was developed in chickens and turkeys, but not

enough to control entirely the worm's ability to transmit the blackhead agent. Dry weather directly reduced the probability of blackhead transmission through direct action on the parasite and its vector. It also indirectly reduced the likelihood of transmission to poultry by reducing the availability of earthworms which collect and store the blackhead parasite and its vector in their bodies when feeding. (I) Beltsville, Maryland. 24-E

Fluorescent Antibody Test Developed for Identifying Histamonads. A specific Histomonas meleagridis (the protozoan causing blackhead in turkeys) antiserum was produced in rabbits, conjugated with fluorescein, and successfully used to identify histomonads in cell culture fluids and experimentally-infected turkeys. Attempts are now being made to use the system in making biological studies of histomonads in transport hosts. (E) Texas Agr. Exp. Sta. 24-E

Artificial Cultivation of the Blackhead Organism. The causal agent has been cultivated artificially for 8 years. During that time, it has lost its ability to grow, except sparsely, in chickens and turkeys, and no longer produces a measurable degree of resistance on the part of the bird to infections of natural strains of the parasite. In addition, the organism can now be cultivated artificially with only some of the bacteria with which it was associated in cultures at the beginning of the experiment. Moreover, the cultivated parasites have failed to maintain themselves in birds hatched and maintained without bacteria in their intestines. The organisms appear to be gradually veering away from the characteristics of parasites toward characteristics of the free-living protozoa. (I) Beltsville, Maryland. 24-E

Mass Production of Cuticular Material for Use as Antigen in Indirect Fluorescent Antibody Test for Trichinosis Achieved. By holding trichinous pork at 0 F. for 20 days, before it was thawed and digested artificially, relatively clean cuticular material for use in the indirect fluorescent antibody test for trichinosis was obtained. About 98 percent of the larvae were completely digested except for the cuticle; the remaining 2 percent had ghost forms within the cuticle where the larva had been prior to digestion. By repeatedly washing and sedimenting the residue, relatively clean concentrated cuticular material can be provided for this test. The availability of this material in quantity is important as nematode cuticle is one of the principal binding sites for the detection of antibody in this test. (I) Beltsville, Maryland. 25-E

Gamma Globulin Tested Against Swine Parasite. Non-chemical methods for control of internal parasites of swine are being sought through studies on the immune process which normally results following natural infection. Gamma globulin was extracted from the sera of swine which were immune to Strongyloides ransomi as a result of prior infection. Injections of the gamma

globulin into susceptible pigs prior to their exposure to the parasite failed to provide any evidence of protection against parasite infection. (E-fg) Georgia Agr. Exp. Sta. 25-E

Nonpathogenic Populations of Haemonchus contortus Found. Studies concerned with isolation of relatively nonpathogenic populations of the important worm parasite of sheep, Haemonchus contortus, with the aim of developing a vaccine have been outstandingly successful. In 2 years of study, 53 collections were made from widely separated areas in the U.S. Twenty-six populations were grown successfully in seed lambs. Seventeen have been studied intensively and nine additional are in current intensive evaluation. Three relatively nonpathogenic populations have been found. Plans are being developed to study the ability of the nonpathogenic populations to compete with normal populations. (E) Wisconsin Agr. Exp. Sta. 26-E

Infections with the Sheep Nodular Worm, Oesophagostomum columbianum, in Calves Does Not Protect Against Challenge Inoculation with O. radiatum, the Common Nodular Worm of Cattle. Two calves were inoculated with 15,700 infective larvae of Oesophagostomum columbianum and on the 81st day after this initial infection were challenged with 25,000 infective larvae of O. radiatum. On the 41st day after challenge, necropsy of a principal and control calf disclosed that the principal calf harbored 560 more O. radiatum than the control. This result indicated that a single inoculation with O. columbianum larvae did not protect this calf against challenge inoculations with O. radiatum. (I) Beltsville, Maryland. 26-E

Immunity to Sheep Nematodes. Attempts to transfer immunity to Haemonchus contortus in lambs with whole blood, serum, and gamma globulins from resistant sheep were not successful. This suggests that the factors responsible for resistance to reinfection are not likely to be present in the body fluids. Single exposures of sheep to infections with these nematodes did provide protection to re-infection. This protection disappeared when thiabendazole treatment was administered before challenge. (E-fg) Indiana Agr. Exp. Sta. 26-F

Hypersensitivity Reaction Suggested in Nematode Immunity. Worm-free lambs were used to evaluate immunity produced by multiple exposures (vaccination) to live nematodes, Oesophagostomum columbianum. The lambs were destroyed at various intervals after oral challenge to determine resulting degrees of infection and parasite-induced tissue reactions. Fewer challenge parasites invaded the intestinal tissues in animals receiving multiple vaccinations; however, the tissue reactions to invading parasites was much more severe in these animals than in those undergoing initial infection. These results suggest that a hypersensitivity reaction develops in animals repeatedly exposed to the parasite. (E-fg) Missouri Agr. Exp. Sta. 26-F

Field Crops

Food Spray Attracts the Predator Chrysopa carnea. Cotton and alfalfa plots received food spray applications in the attempt to attract predator Chrysopa carnea adults and induce them to oviposit. Other tests were conducted to determine if the food sprays were attractive from a distance. The standard food spray (700 g sucrose, 400 g enzymatic protein hydrolysate of yeast in 1000 ml water) was applied to cotton and alfalfa plots. Chrysopa adult response to the treated plots was evident. In two cotton plots, the food spray was applied to stakes covered with heavy wax paper placed about every 24 feet in cotton rows. Through the summer there were about twice as many Chrysopa eggs found in the food spray plots than in untreated areas. (E-fg) California Agr. Exp. Sta. 31-C

Host Specificity in Cereal Grains and Legumes. Water extracts of cereal grains were shown to contain a material or materials attractive to the rice weevil. Water extracts of the blackeye pea contain substances attractive to the cowpea weevil and repellent to the rice weevil. There are indications that water extracts of cereal grains or legumes may contain oviposition attractants. (E) Shaw University. 31-C

Parasite Behavior. In a study of host finding and parasitization of larvae of the Mediterranean flour moth by the parasitic wasp, Exidechthis canescens, the size of the test environment was apparently not large enough for basic differences to show up under different host dispersion patterns. Differences due to host density are developing, however. Percentage of parasitization was highest at 30-density host levels, less at 100-density levels, and least at 200-density levels. At the high level, a 90-egg mean may indicate this is about the maximum number of eggs the female lays under these conditions. (E) University of California. 31-C

Further information was obtained on the comparative effectiveness against the Mediterranean flour moth of 9 preparations containing Bacillus thuringiensis, plus 3 new ones added to the testing program this year. Analysis and summary of the results will be in the final report of the project. Part of the program has been coordinated with that of the Working Group for Standardization of Biopreparations since the meeting of the International Colloquium for Biological Control in Wageningen, Netherlands, in September 1966. (P.L. 480) Institute for Plant Protection, Poznan, Poland. 31-C

Nature and Variability of Resistance to Disease in Plants. Research was continued in the detection and evaluation of sources of resistance in oats to race 6AF of Puccinia graminis avenae. Two types of resistance to race 6AF

have been detected in hexaploid oats. One type is effective when plants are seedlings but not in adult stages; and, a second type, found in line C.I. 3034, conditions resistance in adult plants but not in the seedling. In this line rust resistance in adults is evident only after the plants have headed. A few lines of oats have been found with both seedling resistance and adult plant resistance to race 6AF. Studies are continuing in elucidating the antibiotic action of the culture filtrate from Helminthosporium sativum against race 32 of Puccinia graminis tritici. The filtrate acts as a rust protectant when sprayed to run-off on Marquis wheat seedlings which are then inoculated with rust urediospores; it acts as an irradicant and as a protectant when seedling leaves of Marquis are submerged in the filtrate prior to and subsequent to rust inoculation respectively. (E-fg) Minnesota Agr. Exp. Sta. 32-B

Toxicity of Hydrogen Phosphide to Stored-Product Insects. Hydrogen phosphide was originally developed for the treatment of bulk grain but at the present time investigations are being conducted to determine its possible use for other types of fumigation and with various commodities. The toxicity of hydrogen phosphide (H_3P) to the following stored-product insects under various conditions of exposure time (2, 4, 8, 16 and 24 hours), and temperature (60° , 70° , and 80° F.) was determined: A. obtectus adults; G. cornutus larvae and adults; L. serricorne larvae and adults; O. surinamensis adults; P. interpunctella larvae; R. dominica adults; S. granarius eggs, larvae, pupae and adults; S. oryzae eggs, larvae, pupae and adults; S. paniceum larvae and adults; T. confusum eggs, larvae, pupae and adults; and T. sternale larvae. (E-fg) California Agr. Exp. Sta. 32-C

Evaluation of Effects of Radiofrequency (RF) Electric Fields on Stored-Grain Insects. T. molitor (L.) larvae were exposed to both continuous and pulse-modulated RF electric fields. Continuous exposures were conducted at a frequency of 39 mc. using 3.5 kv. for 5.5 sec., whereas the pulse-modulated treatments were made at the same frequency at an energy level of 6.0 kv. at the rate of 20 pps. using a pulse width of 5 ms., respectively. RF treated larvae lost significantly more weight than the starved and control larvae during the five days following RF exposure. The respiratory rates of RF treated larvae were significantly higher than the rates for the control insects. This increase in oxygen consumption in RF treated larvae persisted throughout the fourth day following RF treatment. The rate of incorporation of labeled amino acids into soluble protein was higher in RF treated insects as compared to control insects. (E-fg) Nebraska Agr. Exp. Sta. 32-C

Gamma-Ray Effect on Insecticides. Wheat was treated with malathion at the rate recommended for application as a protectant. Portions were treated with 25 and 100 krads, within the range of estimated practical radiation levels. Samples were subjected to bioassay with red flour beetles and to

chemical analysis at intervals subsequent to irradiation. Biological effectiveness of the malathion was not impaired and the degradation of the insecticide proceeded normally. Several dosages of malathion and synergized pyrethrum were applied to strips of brown kraft paper and irradiated at 25, 50, 100, 500, 1,000, and 4,300 krad. The last two are massive radiation levels and should reveal whether there would be any adverse effect on these insecticides. There was none revealed by bioassay tests with red flour beetles at intervals after radiation was applied. (I) Savannah, Georgia. 32-C

New Resistance from New Wheat Hybrids. Hybrids of rye x wheat have genes that carry resistance to several diseases. Advanced lines have been developed that carry resistance to powdery mildew from the rye parent. This resistance is being transferred to commercial varieties. Likewise, good potentials for disease resistant wheat hybrids lie in the already successful crosses between Agropyron spp. and wheat. Agropyron carries resistance to several diseases and the successful use of the Agropyron resistance to leaf rust is already being realized. (I) Tifton, Georgia; Stillwater, Oklahoma; and Beltsville, Maryland. 321-B

New Rust Resistant Wheats Released. Among new varieties of wheat released cooperatively with several State agricultural experiment stations, 'Guide', a new hard red winter wheat is resistant to stem rust; 'Riley 67', a soft red winter variety has a high degree of resistance to leaf rust; and 'Federation 67', a soft white spring wheat is resistant to stripe rust. Resistant to the common forms of both stem rust and stripe rust is the newly released hard red spring variety, 'Moran'. (I) Nebraska, Indiana, Idaho. 321-B

Leaf Rust Disease of Wheat. Wheat leaf rust trap plots consisting of seven universally resistant varieties and two varieties with degrees of adult plant resistance were planted at various locations. One of the universally resistant varieties had considerable evidence of infection this year. Cultures of rust from this variety (Aniversario) are being studied in the greenhouse. The two varieties with adult plant resistance only were rather severely infected and were dropped from the tests. Three new sources of seedling resistance and one variety with adult plant resistance were advanced to the trap plot preparatory to planting at other trap plot locations. Four selections with genes covering resistance to the spectrum of races now present have been purified and turned over to the wheat breeder. Three specific genes for resistance have been transferred to a common genetic background (Comanche) and have reached the F₃ generation of the fourth backcross. (E-fg) Oklahoma Agr. Exp. Sta. 321-B

Varietal Resistance of Wheat to Stored-Grain Insects. About 800 varieties of wheat from the World Collection were screened in India for resistance to

attack by the rice weevil. Less than five weevils per test sample emerged from about 5 percent of the varieties. Of 300 varieties tested against the lesser grain borer, 5.6 percent showed significant resistance to attack. (P.L. 480) Indian Agr. Res. Inst., New Delhi, India. 321-C

Inert Dusts on Wheat in Kansas. Malathion and one or two diatomaceous earths tested were effective in preventing insect infestation for 3 years in dry wheat ranging 10 to 12 percent moisture and stored in 3,250-bu. circular metal bins in Kansas. Another diatomaceous earth and two silica aerogels were not effective. All check bins of untreated wheat became heavily infested. (I) Manhattan, Kansas. 321-C

Wheat Resistance to Cereal Leaf Beetle. Several thousand varieties of wheat, oats, and barley have been evaluated for resistance to the cereal leaf beetle. Successful crosses have been made between resistant wheat varieties and adapted hard red winter wheats, hard red spring, soft winter, and durumms. In field tests 29 F₄ progenies from crosses with Crim (spring) and 62 F₄ progenies with Chris (spring) had only trace amounts of cereal leaf beetle damage under a heavy infestation. In this same test 211 F₄ winter lines showed a high degree of resistance. (I) East Lansing, Michigan. 321-C

Controlled Atmosphere in Wheat Bins. Concentrations of more than 35 percent of carbon dioxide and less than 14 percent of oxygen were maintained for 4 days in the interstitial atmosphere of wheat in 500-bu. metal bins when purged with carbon dioxide. This combination was shown in laboratory tests to be effective in controlling many stored-grain insects. An inexpensive recirculation system was designed for the 500-bu. bins, along with a set of control devices for the automatic application of the carbon dioxide to maintain the desired concentrations of atmospheric gases. The control system uses a solenoid, a timer, and a flowmeter. This system might also have a potential use for aiding in the distribution of fumigants in grain bins. (I) Savannah, Georgia. 321-C

Cereal Leaf Beetle Resistance Studies. Two spring varieties of barley from the World Collection, one from Iran and one from Poland, were determined to be resistant to cereal leaf beetle. Crosses between the two produced progenies, some of which were more resistant than either parent. A significant number of selections and species of wheat have continued to show resistance over a three-year period of testing. Leaf hairiness is associated with resistance in wheat. (Coop. with ENT, New Crops) (E) East Lansing, Michigan, and (I) Lafayette, Indiana. 322-B

Adult Resistance to Stem Rust of Oats. Only one oat genotype had previously expressed adult resistance to the extremely virulent race of stem rust,

6AFH, which has become established in the North-South movement in the Mississippi River Valley. However, among selections of Avena sterilis tested in 1967 in Puerto Rico to this race, several have shown the characteristic of "slow rusters" and can produce adequate seed. If this "slow rusting" can be transferred to good agronomic types of oats, it should give adequate protection from stem rust under field conditions. Special tests will be conducted in Puerto Rico in 1968. (I) Mayaguez, Puerto Rico. 323-B

Diseases of Small Grains. Continuous cropping of mosaic-susceptible oat varieties for four years on virus infested soil resulted in a gradual increase in mosaic and a decrease in yield. Early Ballard (resistant) variety yields remained constant. Leaving the land fallow or planting wheat on the land resulted in a significant reduction in mosaic when oats were subsequently planted. The oat variety Victorgrain was susceptible to seedling blight caused by Helminthosporium victoriae, H. sorokinianum and H. avenae. The variety Arlington 23 was susceptible only to H. avenae and Arlington was resistant to all three fungi. Fungi associated with stored oats (with the exception of Aspergillus flavus) did not appear on oats in the field even when the seeds were heavily contaminated. (E-fg) South Carolina Agr. Exp. Sta. 323-B

Insect Attractants in Rice. Two fractions highly attractive to rice weevils have been isolated from rice by solvent extraction. They could not be recovered from rice by steam distillation, and nitrogen aeration gave only a very small yield. Ether was a suitable solvent but yield of the two crude attractants was estimated at less than 30 mg. per kilo of polished rice. Two attractant fractions have also been isolated from rice bran. Chemical identification of the fractions is now being attempted. (P.L. 480) Tokyo Univ. of Agr., Japan. 324-C

Dawn--A Blast Resistant Rice Variety. This early maturing, long-grain variety of rice was developed and released in Texas. It is the first commercial long-grain variety with outstanding resistance to United States races of the blast fungus (Piricularia oryzae) and also to brown leaf spot. Although it is not resistant to all leaf diseases, the leaves remain green until maturity. Reaction of Dawn to stem rot, leaf smut and white tip is undetermined. However, no difficulty is expected from these three diseases because losses from them in the United States have been minor. (I) Beaumont, Texas. 325-B

Corn Stunt Virus in the Southern States. Corn stunt appears to be limited to Mississippi, North Carolina, and other States in the South. It has been found in most of the southern States. Johnsongrass serves as the overwintering host and transmission is by leafhoppers which include species of

Dalbulus and Graminella nigrifrons. The latter is an inefficient vector but because of its abundance it accounts for the early season spread. Sources of resistance to stunt are available. (I) State College, Mississippi. 326-B

Downey Mildew of Corn and Sorghum. This disease has been reported from Texas and Mississippi and appears to be increasing on both corn and sorghum. Fungicidal control is not practical nor reliable but resistance in corn to this disease has been observed in the Philippines (P. L. 480 research). Some of these resistant types are under observation in Texas. Resistance has been found in some items in the World Sorghum Collection (P. L. 480 India) which were grown in Nigeria. Breeding and inheritance studies involving this material are currently in progress. (I) College Station, Texas. 326-B

Gibberella zeae Ear Rot of Corn. Three methods of artificial inoculation with Gibberella zeae were compared. They were spraying with spore suspension on the silks, injecting a spore suspension into the ears, and insertion into the tip of the ear of toothpicks over which G. zeae had grown. Spray inoculation shortly after silking appears to be the most efficient technique. (I) Lafayette, Indiana. 326-B

Inert Dusts on Corn in Illinois. Two diatomaceous earths and one silica aerogel kept shelled corn in the 12 to 13 percent moisture range insect-free for 3 years, stored in 3,250-bu. circular metal bins in Illinois. A second silica aerogel was only slightly less effective. Malathion kept the corn insect-free the first year, three bins of five were lightly infested after 2 years with an average of 0.24 insect per 1,000 grams, and all five bins were infested after 3 years with an average of 3.5 insects per 1,000 grams. (I) Watseka, Illinois. 326-C

Inert Dusts on Corn in Georgia. After 36 months of storage, corn in replicated series of 500-bu. bins treated with 2 diatomaceous earths, 2 silica aerogels, and malathion was all highly insect-infested. The malathion is recommended for only 1 year of storage but had only half as many insects as the best inert dust. At load-out after 42 months the malathion-treated corn had lost 6.5 percent in weight, the inert dusts 8 to 15 percent, and the untreated check 18 percent. Rate of flow for the inert-dust treatments was only 19 percent less than the malathion at load-out but there was a 43 percent reduction at load-in. (I) Tifton, Georgia. 326-C

Corn Resistance to Rootworm. Performance of F₁ and S₁ corn lines to heavy rootworm infestations have shown that the lines HD 2187, SD10, B14, C121E, and Mo22 are highly resistant and transfers this resistance to hybrid lines. (I) Brookings, South Dakota. 326-C

Mechanism of Corn Earworm Resistance. Nine replicated experiments with a total of 186 entries (hybrids, inbreds and single-crosses) were carried out to evaluate and study the mechanism of corn earworm resistance in the field. Silks, husks and kernels of resistant and susceptible lines were harvested and frozen for bioassay and chemical determinations to study corn earworm resistance in the laboratory. (E-fg) Missouri Agr. Exp. Sta. 326-C

Germ Plasm for Corn Borer Resistance. In State-Federal cooperative programs, 6 yellow synthetic varieties of corn of a group of 16 released to breeders in 1967, are elite sources of germ plasm for resistance to the European corn borer. One yellow inbred line, which has excellent resistance to European corn borer, good resistance to northern corn leaf blight, and good tolerance to northern corn rootworm, was released to breeders and seed producers. (I) Ames, Iowa, and Wooster, Ohio. 326-C

Progress in Control of Witchweed (*Striga lutea* Lour.). Witchweed is a parasitic weed capable of parasitizing corn and many other grass crops. The seed of this weed normally lie dormant in the soil until contacted by a germination stimulant which is released by certain plants, including host plants. None of our control measures, except for certain expensive fumigation and sterilization treatments, are effective against the dormant seed. The ability to induce germination of the dormant seed would greatly enhance our chances of eradicating this pest from the area now under quarantine. In 1966, AR scientists discovered that an active stimulant can be collected from many fresh-water streams, ponds, and lakes. In 1967, they also discovered that an active stimulant can be extracted from certain agricultural soils with acetone. Water extracts of the soil do not contain the active stimulant. Although no practical use of these findings has resulted, as of the present, they do raise our hopes of being able to induce germination of witchweed seed in the future. (I) Whiteville, North Carolina. 326-D

Biological Activities of Seed Chalcids in Legume Seed. Two seed chalcid species were found on legumes. The chalcid species on alfalfa would not infest red clover and the species on red clover would not infest alfalfa. It was found that alfalfa seed chalcid populations were maintained at extremely low numbers by native parasites whereas red clover seed chalcid populations were ineffectively controlled by native parasites. None of the insecticides commonly applied to legume seed fields gave commercial control of either seed chalcid. (E-fg) Idaho Agr. Exp. Sta. 33-C

Diseases of Forage Grasses. Greenhouse studies are in progress to evaluate the relationship between disease damage and nitrogen fertilization. Field plot data indicated that damage due to Helminthosporium spp. in Kentucky bluegrass increased at a relatively slow rate with heavy nitrogen

application, but that growth of the grasses (particularly rate of production of disease-free tissue) occurred at a much more rapid rate. The result was a higher incidence of disease-free grass in treatments containing high rates of nitrogen application. Studies on nitrogen utilization by this pathogen are being investigated to determine whether this may be related to the rate of disease development in the host. (E-fg) West Virginia Agr. Exp. Sta. 331-B

Grasshopper Viruses Studied. The two viruses from Bozeman have been partially purified by a sucrose density gradient and ultracentrifugation technique and some of the physical and chemical properties determined. (E) Montana State University. 331-C

Grasshopper Viruses Isolated. Two viruses isolated from grasshoppers appear promising for use in control. One attacks the fat bodies causing reduced fecundity and increased mortality and the other attacks the muscle tissue causing up to 50 percent mortality of nymphs. (I) Bozeman, Montana. 331-C

The Interrelation of Nematodes and Other Pathogens in Plant Disease Complexes. Research is underway to provide germ plasm for the development of an alfalfa variety resistant to root-knot nematode with combined resistance to stem nematode, bacterial wilt, spotted aphid, and pea aphid as well as one immune to root-knot nematode to be used as a trap-crop. A total of 279 winter hardy progeny plants of the selfed duplex M. hapla-resistant parent clones were test crossed to susceptible parents and simultaneously selfed and/or sibbed. Progeny of the M. hapla-resistant non-hardy selections were selfed and/or sibbed. This will both concentrate resistance in this material and provide segregation ratios to separate duplex from the simplex genotypes. (E-fg) Nevada Agr. Exp. Sta. 332-A

Alfalfa Resistant to Verticillium Wilt. Two cycles of resistance selection involving varieties, selections and breeding lines from the United States and Europe were completed. The Verticillium wilt disease of alfalfa is widespread and destructive in parts of Europe but the disease has not yet been observed on alfalfa in the United States. (E) Istituto di Allevamento Vegetale, Facolta di Agraria del Universita, Perugia, Italy. 332-B

Cercospora Disease of Alfalfa and Other Forage Legumes and Breeding for Resistance. Nine clones of alfalfa, seven with some resistance to Cercospora medicaginis and two susceptible, were crossed in a diallel manner. F₁ progenies in the seedling stage were established in a field trial for agronomic and ecological studies. Other seedling populations of these progenies were tested in the greenhouse for resistance. A better understanding of the genetic nature of resistance to this important fungus in the black stem complex in alfalfa should be attained from selfing the F₁ plants and back-crossing programs. (E-fg) Iowa Agr. Exp. Sta. 332-B

Multiple-Pest Resistant Alfalfa Released. "Dawson" an alfalfa variety resistant to pea aphids, spotted alfalfa aphid and bacterial wilt disease was released to midwestern growers. (I) Lincoln, Nebraska. 332-B, C

Alfalfa Resistance to Leafhopper and Aphids. Sixty-eight clones were selected out of 550 plants in the alfalfa nursery as having apparent leafhopper resistance. These 68 plants were tested against the pea aphid and spotted alfalfa aphid, and 19 were classed as resistant to both aphids. (I) Lincoln, Nebraska. 332-C

Alfalfa Weevil Control by Flaming. Flaming dormant alfalfa with a liquid propane burner in March 1966 gave control of the alfalfa weevil equal to a standard insecticide treatment. However, in 1967 the period of larval damage was more extended than normal and two applications of insecticide or one flaming and one insecticide application were needed to adequately protect the crop. (I) Beltsville, Maryland. 332-C

Alfalfa Weevil Parasitism. The incidence of parasitism of the alfalfa weevil by Bathyplectes curculionis was lower in New Jersey and Maryland in 1967 than in 1966. Parasitism up to 40 percent was recorded. Another parasite, Tetrastichus incertus, occurred commonly in June when host populations were low. A parasite of the adult weevil, Microctonus sp. (Black), was recovered in a Beltsville field. (I) Beltsville, Maryland. 332-C

Alfalfa Resistance to Spotted Alfalfa Aphid and Pea Aphid. A total of 32,670 alfalfa seedlings were exposed to both aphids and 5,200 survived the test. Of 856 Cody x DuPuits plants cage tested 365, 327, and 227 were resistant to the spotted alfalfa aphid, pea aphid, and both aphids, respectively. (E) Kansas State University. 332-C

Alfalfa Resistance to Seed Chalcid. About 90 plants were screened from 1400 progenies of a 22 clone alfalfa synthetic showing some resistance to the alfalfa seed chalcid. About half of these showed a high level of resistance in cage tests. (I) Mesa, Arizona. 332-C

Alfalfa Resistance to Weevil. A total of 116 plants have been selected from old alfalfa fields as possible sources of germ plasm resistant to the alfalfa weevil. (I) Beltsville, Maryland. 332-C

Flaming for Insect Control. Flaming tests were made on captive alfalfa weevils and on pupae of Bathyplectes curculionis, a parasite beneficial in control of alfalfa weevil. Good results were obtained in controlling the weevil, but flaming may also be highly detrimental to the parasite. (E-fg) Colorado Agr. Exp. Sta. 332-C

Host Preference of Alfalfa Weevil, *Hypera Postica* (Byll.) in Relation to Plant Produced Attractants and Repellents. Investigations have continued on the characterization of the two active fractions which have been isolated from the crude alfalfa weevil attractant. Failure to produce consistent infrared spectra has brought about a change in the fractionating procedure; the thin-layered chromatographic separation has been replaced by column chromatography, using the same general pattern of solvents. Ultra violet spectra of both the active fractions and of the crude attractant were recorded. Several peaks of absorption were evident. Assay of the 59 fractions (obtained by column chromatography) by means of presence or absence of ultraviolet absorption has yielded four major fractions which possess compounds also present in active components of the crude attractant. It is intended to assay these four fractions for attractiveness to the weevil before proceeding with any further chemical investigations. (E-fg) Maryland Agr. Exp. Sta.

332-C

Control of Insects Injurious to Alfalfa. Spotted alfalfa aphids were counted on field plots of resistant and susceptible alfalfa. Average percentage controls for resistant varieties for the three dates were Cody, 72 percent; and KS-10, 88 percent. A set of 52 clones was maintained in the greenhouse for color analysis of the flowers as well as a simulated field test of their honey-bee preference. (E-fg) Kansas Agr. Exp. Sta.

332-C

Sweetclover Weevil Response to Plant Constituents. A feeding stimulant and a deterrent have been found in varieties of sweetclover susceptible and resistant to the sweetclover weevil. A second feeding deterrent has been found in *Melilotus infesta* which may account for the near immunity of this species. (E) University of Nebraska.

333-C

Nature of Resistance to Sweetclover Weevil. A bioassay technique was developed for selecting sweetclover constituents which stimulate or deter feeding by the sweetclover weevil. To date, one stimulant and two deterrents have been detected. (I&E) Nebraska Agr. Exp. Sta.

333-C

Hot-Water Treatments Control Nematodes and Reduce Need of Nematocides on Turf. Tifgreen and Tifdwarf bermudagrass sprigs were placed in hot-water baths to determine kill of nematodes in grasses. Hot-water treatments consisted of 21, 45, 40, 55, and 60 C for 5 and 10 minute intervals. Sprigs of both varieties were killed at temperatures of 60 C, but not at lower temperatures. Cores of Tifgreen bermudagrass sod one-inch in diameter and approximately 3 inches long infected with nematodes (*Criconemoides* sp., *Hypsoperine* sp., and *Tylenchorhynchus* spp.) were held in water at 55 and 60 C for 12, 30, and 45 minutes. After hot-water treatment, the cores of soil were planted in pots containing sterile soil. After 4 months, nematode

counts were taken. These studies indicated that nematodes were eradicated by hot-water treatment at 55 C for 15 and 30 minutes. (I) Tifton, Georgia. 335-F

Ecology of Brown Stem Rot in Soybean. Studies have confirmed red clover as an alternate host for the brown stem rot organism, Chephalosporum gregatum. This finding will have an effect on the recommended cultural control practices. (I) Ames, Iowa. 341-B

New Nematode-Resistant Soybean Variety. The new soybean variety, Dyer, was released in March 1967, by the Tennessee Agricultural Experiment Station, Missouri Agricultural Experiment Station, and Crops Research Division, Agricultural Research Service, United States Department of Agriculture. It has excellent resistance to the soybean cyst nematode, a serious pest known to occur on almost two million acres of farm land in North Carolina, Virginia, and seven States in the Mississippi Valley. In one test over a three-year period on cyst-infected plots in Tennessee, Dyer produced an average of 12.4 bushels more per acre than Hill, a commonly used but susceptible variety. This new variety also has good resistance to two other important and widely distributed nematodes of soybean, the southern and the cotton root-knot nematodes. It is suited to Tennessee conditions and has oil content and agronomic character comparable to other varieties used. This new variety is recommended primarily for use in fields where cyst and root-knot nematodes occur. (I) Jackson, Tennessee. 341-F

Breeding Soybeans Resistant to the Cyst Nematode. Custer and Dyer, two new cyst nematode resistant varieties, were released to certified growers in cooperation with four agricultural experiment stations. These two varieties and the later-maturing variety Pickett will provide resistant types for all areas where the cyst nematode has been reported. Custer, developed in Missouri, is also resistant to Phytophthora root rot. Dyer, developed in Mississippi and Tennessee, is resistant to the root knot nematode but is not resistant to Phytophthora root rot. (I) Columbia, Missouri, Stoneville, Mississippi. 341-F

In the Southeastern Coastal Plains, Sting Nematodes (B. longicaudatus) Pose a Major Threat to Soybean Production. To locate possible sources of resistance, 57 varieties or advanced screening lines were rated for nematode host susceptibility; eight were found containing at least moderate tolerance. These lines all contain PI 1613453 germ plasm. Fourteen soybean varieties were tested for resistance to Louisiana populations of M. incognita and Rotylenchulus reniformis. None showed appreciable resistance or tolerance to the reniform nematode, and the order of resistance to Louisiana root-knot populations was Bienville, Hill, Jackson, Pelican, and Bragg. (I) Charleston, South Carolina. 341-F

Genetic Resistance to Flax Rust. All flax varieties recommended for growth in the North Central States have genetic resistance to flax rust and are not affected by the disease. (I) Fargo, North Dakota. 342-B

Safflower Resistant to Rhizoctonia. The safflower breeding line N4051 was shown to have a high and measurable resistance to Rhizoctonia solani in the seedling stage. This discovery has high scientific value because seedling resistance to Rhizoctonia is rare. (I) Logan, Utah. 343-B

Resistance to Safflower Rust. Safflower rust may cause considerable damage to the crop, particularly in the seedling stage. Genetic resistance has been found that gives a modest degree of protection in both the seedling and mature stages of growth. (I) Logan, Utah. 343-B

Peanut Pod Breakdown Suppressed by Landplaster. Heavier than normal applications of landplaster (1500 to 3000 pounds per acre) suppress pod breakdown and increase the yield and quality of peanuts in Virginia. Calcium in the landplaster has been shown to be primarily responsible for the suppression of pod breakdown. A low calcium-potassium ratio tends to predispose peanut fruits to pod breakdown. One form of pod breakdown is caused by Pythium spp., another to Rhizoctonia spp. (I) Holland, Virginia. 344-B

Successful Field Test with Controlled Atmosphere. Carbon dioxide was applied in a large concrete silo 113 feet high and 30 feet in diameter, with a volume of 78,000 cubic feet, which was filled with farmers stock peanuts. Plastic tubes were placed at different depths and locations in the silo to sample for carbon dioxide and oxygen concentrations. The carbon dioxide was pumped from a tank truck into the top of the silo. A uniform concentration of 35 percent carbon dioxide and 14 percent oxygen was obtained and maintained for 7 days. Laboratory studies had shown these concentrations were effective against many stored-peanut insects. The cost of the gas for a 4-day treatment period was estimated to be slightly more than one-half cent per bushel, a cost competitive with fumigation, but the new treatment leaves no residue. (I) Savannah, Georgia. 344-C

Peanut Resistance to Thrips. Significant differences in thrips damage were observed among 481 peanut lines. Sixty-one entries were selected as showing resistance to thrips. (E) Oklahoma State University. 344-C

Search for Genetic Resistance to Peanut Insects. Preliminary results at Tifton, Georgia, in cooperation with Entomology Research Division, indicate that certain accessions of wild species of Arachis have a high degree of resistance to spider mites. Young larvae of the lesser cornstalk borer preferred young seedlings of certain genotypes of cultivated peanuts to others

under greenhouse conditions. Thrips and corn ear worm preferred certain varieties. Larvae of the southern corn rootworm survived differentially in preliminary tests when confined on freshly germinated seedlings of a wide range of genotypes of cultivated peanuts. In North Carolina 19 additional genotypes of cultivated peanuts have been found to be less preferred than susceptible commercial varieties to infestation and feeding by adults and larvae of southern corn rootworm under both field and laboratory conditions. (E) Georgia and North Carolina Agricultural Experiment Stations. 344-C

Search for Genetic Resistance to Rootknot Nematode of Peanuts. At Stillwater, Oklahoma, genotypes of cultivated peanuts have reacted differentially to the northern rootknot nematode in tests under controlled conditions in greenhouse and growth chambers, but firm evidence of genetically usable resistance or tolerance to this pest in cultivated peanuts has not been obtained. Certain accessions of wild species of Arachis appeared highly resistant or immune to the northern rootknot nematode in preliminary tests. (I) Stillwater, Oklahoma. 344-F

Castorbean Breeding Lines Resistant to Botrytis Capsule Mold. Three castorbean breeding lines, each from F₈ selections from the cross of Baker 296 X Hale, show appreciably more resistance to capsule mold than the Hale variety at Beltsville. Two lines are superior to lodging caused by rain and wind. (I) Beltsville, Maryland. 346-B

Development of Fusarium, Verticillium, and Root-Knot Resistant Varieties of Cotton. Research is continuing in the development of strains of cotton with combined resistance to Fusarium wilt, Verticillium wilt, and the cotton root-knot nematode. A Fusarium-resistant, smooth leaf upland Gossypium hirsutum, designated NF 27 (or N 1135-27), was developed by hybridization as a recurrent parent for use in two backcross programs that utilize the resistance to Verticillium wilt and the cotton root-knot nematode found in G. barbadense. Three groups of agronomically similar cotton strains that differ primarily in disease resistance have so far been developed: Fusarium-resistant, Fusarium-resistant plus Verticillium-resistant, Fusarium-resistant plus root-knot-resistant. These are being united into acceptable strains with combined resistances. (E-fg) Mississippi Agr. Exp. Sta. 351-A

Cotton Disease Complex--San Joaquin Valley. An accelerated research program on verticillium wilt in the eastern portion of the San Joaquin Valley of California is progressing satisfactorily. A more virulent strain of the verticillium wilt fungus has apparently built up in that area of the San Joaquin Valley. The commercial wilt-tolerant varieties commonly grown in California are able to withstand the disease with minor losses in most areas of

the State, but in the Tulare and Ringa Counties, losses have been steadily increasing. Rotation with nonsusceptible crops increases yield and reduces incidence of the disease. Heavier than normal plant populations also reduce the amount of wilt with some increase in yield. (I) Shafter, California.

351-B

The Role of Crop Residues in the Control of Phymatotrichum. The growth of winter cover crops continues to decrease disease development, whether or not residues were incorporated into the soil. This reduction in cotton root rot has been cumulative over a six-year period. Control by the incorporation of residues on winter fallow soil has not been cumulative; control each season has been related to tonnage of residue incorporated and not to chemical composition of the residue. Other studies have shown that certain organisms isolated from the soil are capable of inhibiting cotton root rot fungus, Phymatotrichum omnivorum in vitro. Many organisms exerting inhibitory activity in culture have also been isolated from the rhizospheres of native desert plants. (E-fg) Arizona Agr. Exp. Sta.

351-B

The Influence of Microbial Antagonists on Verticillium albo-atrum. The A-36 isolate of Streptomyces was highly antagonistic to Verticillium albo-atrum and readily utilized cotton crop residues as a substrate. In replicated field tests using composted cotton residue (36 tons per acre) with and without A-36 inoculum, the rate of development of Verticillium wilt symptoms was somewhat reduced. This also occurred in greenhouse cotton tests. However, wilt incidence was the same by late August for both compost treatments and untreated plots. The failure to bring about antagonism under field conditions is unexplained. An ether-soluble fraction from the mycelium of isolate A-36 did not have sufficient antibiotic activity to explain the total activity of the antagonist. Attempts to demonstrate activity in other fractions have been largely unsuccessful, although a crude water extract did show some additional activity. Studies are in progress to purify the active ingredient. (E-fg) New Mexico Agr. Exp. Sta.

351-B

The Seedling Disease Complex of Cotton. Another selection cycle of disease resistant material for seedling disease escape (SDE) was completed. Field plantings indicated about a ten percent improvement in final stand as a result of the previous selection cycle. Selections are now out-performing the established varieties. Nature of escape appears to be seedling growth at low temperatures unfavorable for pathogen growth. Additional studies confirmed the relationship of resistance and sugar content of seed leachates with deterioration. Ability of selections to give a high final stand count was negatively correlated with resistance to Fusarium and Verticillium wilts. Soil fungicide tests again showed that Lanstan plus PCNB and Terrachlor Super X are excellent materials for seedling disease control. Demosan has now given good results in three consecutive years of testing as a soil fungicide for cotton disease. (E-fg) Texas Agr. Exp. Sta.

351-B

Rust Resistance Transferred to Upland Cotton. Through interspecies hybridization, resistance to southwestern cotton rust has been transferred to the agronomically desirable upland-type cotton. Resistance is being transferred by the backcross technique using the commercial upland as the recurrent parent. Each segregating population is evaluated for resistance by greenhouse inoculations and field exposure where natural inoculum is present. The resistant progenies show fewer and smaller rust lesions on the leaves, which results in appreciably less damage to the photosynthetic area of the plant. (I) Phoenix, Arizona. 351-B

Bacterial Blight Immunity in Cotton. Three genetic factors for bacterial blight resistance, B₂, B₃, B₆, when transferred together yield progeny with virtual immunity to the disease. Breeding methodology is known for transferring the resistance genes in combination. Fluctuating diurnal temperatures influence disease expression and assist in rating segregating populations. The three resistance factors were obtained from introduced germ plasm. (I) Stillwater, Oklahoma. 351-B

Verticillium Wilt Resistance in Cotton. Breeding for improved verticillium wilt resistance was given increased emphasis. Acala S3-1, which was released to replace Acala 4-42 in the San Joaquin Valley of California, has an economically useful level of wilt tolerance. In addition, a large number of cotton introductions were evaluated in wilt-free and wilt-infested soils. Material derived from crosses of Peruvian Tanguis cotton and Acala has higher tolerance than current commercial cottons, and progress is being made in improving the agronomic and fiber properties of these strains. Emphasis was placed on developing techniques for screening for wilt resistance by using controlled growing conditions and inoculations. (I) Shafter, California, and Las Cruces, New Mexico. 351-B

Neutrons Promising for Sterilizing Boll Weevils and Pink Bollworms. In preliminary tests neutron irradiation of newly emerged male boll weevil adults and of mature pink bollworm pupae at dosages of 10,000, 5,000, and 2,500 rem produced complete sterility and did not appear to be otherwise detrimental. (I) Phoenix, Arizona. 351-C

Glabrous Cotton Strains Reduce Bollworm and Cotton Fleahopper Populations. Glabrous experimental cotton strains were effective in reducing bollworm egg and larval populations below those on corresponding hirsute strains in a one-half acre cage and in the field. This confirmed previous findings indicating that smooth surfaces were unfavorable for oviposition of the bollworm moth. (I) Brownsville, Texas. 351-C

Spray Droplets of 140, 200, or 300 Microns were Effective Against the Boll Weevil. In cooperative research with the Agricultural Engineering Research Division a device was developed and used to apply azinphosmethyl to field plots in ultra-low volume applications with spray droplets 140, 200, and 300 microns in size. There appeared to be no difference in control of a heavy boll weevil infestation between the various droplet sizes or between ultra-low volume and conventional application of azinphosmethyl. (I) State College, Mississippi.

351-C

Pulsed Ultrasound Tested Against *Heliothis zea* in Cotton. The thesis that pulsed ultrasound has a repellent effect on *H. zea* moths was substantiated in field tests. However, ultrasound was not an effective physical stimulus in preventing bollworm moth movement into a cotton plot. The most efficient ultrasound had a frequency of 20 kc/sec pulse rate of 10 per second, and pulse duration of 10 msec. *H. zea* moths evaded the airspace over the ultrasound test plot but exhibited normal behavior patterns of feeding, mating, and ovipositing while in the sound shadow produced by the cotton plants.

(I) Florence, South Carolina.

351-C

Mass Releases of *Chrysopa* Larvae Control Heavy Infestation of Bollworms on Cotton. In a field test in 1967 *Chrysopa* larvae were released at the rate of 92,000 per acre on June 26 and at 200,000 per acre on July 2, in one-twentieth-acre plots. The seasonal average of bollworm damaged bolls was 44 percent in the untreated check compared with only 3 percent in the *Chrysopa* treated plots. The control was as good as that could be expected with the best currently available insecticide. Results demonstrated the principle of controlling early-season cotton insects with a systemic insecticide followed by mass release of *Chrysopa* for bollworm control a few weeks later. Research to develop this technique as a practical control measure is in progress. (I) College Station, Texas.

351-C

Hampea sp., An Alternate Host for Cotton Boll Weevil. On a plant collecting expedition, plants of *Hampea* sp. were found heavily infested with boll weevils. Since no cotton was growing in the area, this significant finding establishes the fact that *Hampea* is an alternate host of the boll weevil. Subsequently, it has been determined that *Hampea* has a chromosome number of N-13, the same as wild diploid cottons. *Hampea* is dioecious; and the male plant is boll weevil susceptible while the female plants are resistant. (I) College Station, Texas.

351-C

Destroying Fallen Cotton Squares. Further field tests with a flail type machine for destroying fallen cotton squares indicated that boll weevil control could be maintained as long as weather and plant growth conditions permitted regular machine operation. Pickup efficiency for the season varied from 88.1 percent to 100 percent, with a mean of 95.3 percent. Soil surface

moisture appeared to have more effect on efficiency than surface roughness. (I) State College, Mississippi. 351-C

Boll Weevil Oviposition Suppressor in Cotton. Screening large numbers of lines from the Gossypium germ plasm collection shows that boll weevils oviposit less frequently on several lines than they do on a check variety. Ovipositioning on the resistant lines was about 65 percent that of a commercial check variety. The boll weevil oviposition suppressor factor was found to be under genetic control; the mode of inheritance has not been completed. Five of the more resistant lines had the frego bract, a mutant which reduces the size and twists the bracts of cotton. (I) State College, Mississippi. 351-C

Root-knot Nematode Resistance in Cotton. Approximately 200 lines of cotton derived from Gossypium barbadense (darwinii) x Upland and Mexican Wild x Upland were scored for root-knot nematode resistance. Scoring was done on seedlings inoculated under controlled conditions in a greenhouse followed by field evaluation. Excellent resistance was found, particularly in the Mexican Wild material. Crosses were made to combine resistance with other desirable characters and to study inheritance of resistance. Rotation studies demonstrated beneficial effects of using root-knot nematode resistant vetch and resistant cotton rather than susceptible vetch and cotton. (I) Auburn, Alabama. 351-F

Root-knot Nematode Resistance in Extra-Long Staple, Pima, Cotton. The program to transfer root-knot nematode resistance from G. barbadense (darwinii) to cultivated Pima cotton was continued through another backcross generation. Resistance levels equal to that of darwinii can be recovered after backcrossing. (I) Phoenix, Arizona. 351-F

Cigarette Beetle May Yield to Environmental Control. Extensive information has been developed in the laboratory to show temperature and humidity levels adverse or fatal to different stages of the cigarette beetle. Insect-infested hogsheads of tobacco were held at low temperatures to carry the lab findings to a more practical scale. Information is also being accumulated on the temperature and moisture content of hogsheads of stored tobacco in relation to outside and warehouse temperatures and relative humidities. Correlation of all these lab and field data will provide a better understanding of the ecology the cigarette beetle and the relationships of infestation in warehouse storage. This in turn could lead to preventive or control measures based on manipulation or control of environmental factors. (I) Richmond, Virginia. 36-C

Tobacco Budworms Controlled by Wasps. Red-tailed wasp, Cardiochiles nigriceps with the aid of Polistes sp. wasps held the budworm population on

tobacco a light to moderate level until late in the growing season. (E-fg)
Florida Agr. Exp. Sta.

36-C

Physical Control for Tobacco Insects. Many cigarette factories have converted to the use of flowing steam under vacuum for moisture conditioning their tobacco. Although field evaluation research was not completed when the basic research data were published, the industry was convinced of the merits of this method of moisture conditioning as a means of also obtaining insect control. As far as is known, the companies have had no problem with insect survival in the tobacco conditioned by this process. (I) Richmond, Virginia.

36-C

Biological Control of Tobacco Budworm. Commercial formulations of Bacillus thuringiensis and Heliothis virus were as effective as the standard insecticide TDE for tobacco budworm control; treatments applied 5 days after egg hatch were considerably more effective than treatments applied against eggs or 10 days after egg hatch. (E-fg) North Carolina Agr. Exp. Sta.

36-C

Sex Attractant in Cigarette Beetle. The existence of a potent sex attractant produced by female cigarette beetles has been demonstrated. Experimental procedures developed in the study of the carpet beetle pheromone have been used in this study, with adaptations and additions where necessary. Mass rearing procedures were developed and large numbers of females have been isolated. Preliminary indications are that the attractant is relatively stable and can be stored in a deep freeze. Its volatility is such that both short-pass distillation and thin-layer chromatography can be applied. (I) Madison, Wisconsin.

36-C

Breeding and Inheritance of Insect and Disease Resistance. Nineteen varieties, including some susceptible and resistant to the sugarcane borer, were evaluated for a relationship between the distribution of fibrovascular bundles and borer damage. Within this limited group there was no apparent correlation between bundle distribution and borer resistance. There was a better correlation between total fiber and resistance in these varieties. Inheritance studies of selected sugarcane crosses have indicated the possibility of combining disease and insect resistance with other desirable yield components. (I) Canal Point, Florida.

371-A

Sugarcane Resistance to the Sugarcane Borer. Sugarcane variety C. P. 66-491 was the most resistant of 211 varieties tested against the sugarcane borer. This variety was infested 66 percent less and yielded 50 percent more than the average. Its stalks are large and sugar content high. (I) Houma, Louisiana.

371-C

Sugarcane Borer Parasites. An egg parasite, Trichogrammatoidea nana, of a sugarcane borer which occurs in India readily parasitized the sugarcane borer, Diatraea saccharalis. More than 500,000 of these parasites were released in Louisiana. (I) Houma, Louisiana. 371-C

Breeding Sugarbeet for Resistance to the Cyst Nematode (Heterodera schachtii). Heterodera schachtii predisposes sugarbeet plants to attack by soil inhibiting pathogenic fungi causing a serious disease complex. Use of low levels of nematode resistance available in cultivated beet has resulted in greater protection from pathogenic fungi than from the nematode. Three wild species of Beta are immune to the sugarbeet nematode. The immunity from Beta patellaris has been recovered in segregants from b₁ and b₂ progeny of inter-specific crosses. (I) Salinas, California. 372-A

Beet Leafhopper Control Through Host Management. Beet leafhoppers are the only known vectors of curly top virus disease which causes serious losses of several important agricultural crops, including sugarbeets and beans. More than 150 thousand acres of beet leafhopper weed hosts have been re-seeded to crested wheatgrass. This grass effectively replaced Russian thistle and other sugarbeet leafhopper hosts, resulting in greatly reduced leafhopper populations and diminishing disease problems. (I) Twin Falls, Idaho. 372-C

Resistance of Guar to Bacterial Blight. A large number of promising lines resistant to bacterial blight were found among the F₃ and F₄ progenies from crosses of Brooks X Mills and Hall X BI263875-2. Transgressive segregation was observed. Some lines were completely susceptible. Others were more resistant than Brooks or Hall, the resistant parents. (I) College Station, Texas. 38-B

Screening Hops for Resistance to Spider Mites and Aphids. Preliminary screening trials to find breeding lines resistant to spider mites and aphids have given encouraging results. While no lines were found with a high degree of resistance to both pests, some were found resistant to spider mites and others resistant to aphids. A few lines were found that appear more resistant than the commercial Fuggle variety to both pests. Resistance to these pests will reduce, or eliminate, the need for pesticidal sprays. (I) Corvallis, Oregon. 38-C

Horticultural Crops

The Biochemical Basis of Fire Blight Resistance in Pear. Disease resistance to the very destructive fire blight of pear is known and has been incorporated into some promising new varieties. A biochemical study initiated to aid the lengthy breeding procedure resulted in the detection of hydroquinone in pear leaf and stem tissues. This antibacterial compound, which was produced in injured tissues of the 6 pear varieties studied, accumulated in large amounts only in the three blight resistant ones. Present efforts are aimed at evaluating other pear species and varieties with respect to hydroquinone content. (I) Beltsville, Maryland.

41-B

New Plum Variety Frontier and Selections from Fresno Show Resistance to Leaf Disorders in the Southeast. Plums are not grown commercially with success in the Southeast, partially because of leaf disorders. These disorders, some of which appear physiological and others pathological, tend to defoliate the trees and cause small, distorted fruits. The variety Frontier introduced from the USDA program at Fresno, California in 1967, and some hybrid selections of similar parentage to Frontier, have shown unusual freedom from these leaf disorders. Because of these hopeful signs, emphasis has been given to development of new plums adapted specifically to the Southeast. (I) Byron, Georgia.

41-B

Strawberry Breeding for Red Stele Root Rot Resistance. In breeding for resistance to red stele root rot Races A-1, A-2, A-3, A-4, A-5, and A-6 several promising selections with very good horticultural characters are highly resistant to all races except A-5. A few selections are resistant to all races that have acceptable, but not outstanding, horticultural characters. (I) Beltsville and Salisbury, Maryland.

41-B

Introduction of Sentinel Peach, A New Variety Highly Resistant to Bacterial Spot. In sandy soils of the Southeast, bacterial spot caused by Xanthomonas pruni may debilitate peach trees by annual partial defoliation. Immunity to this disease is not known in peach or related species which will hybridize with peach. Varietal differences exist, however, and increased resistance has been a major objective. Sentinel, introduced in June 1966, recombines good fruit characteristics in the Dixigen ripening season with increased bacterial spot resistance. (I) Fort Valley, Georgia.

41-B

Hot Water Treatments for Quality Maintenance. Commercial use of hot water dips for the reduction of decay during marketing has been extended to bell peppers. This is in addition to commercial use on fresh peaches, mangos, and cantaloups reported last year. Research is continuing to

develop the use of hot water dips for other commodities. (I) Harlingen, Texas. 41-B

Vapor Heat Treatment for Quality Maintenance. Research continues to show promise for treating strawberries and figs with heated air at near-saturated humidity as a means of reducing decay during marketing. (I) Fresno, California. 41-B

Effects of Tannins on Spore Germination and Growth of *Fusarium solani* f. *phaseoli* and *Verticillium albo-atrum*. Gallotannin, wattle, canaigre, and chestnut tannins in a complete medium affected spore germination and mycelial growth of *F. solani* f. *phaseoli* and *V. albo-atrum*. At a concentration of 1,000 ppm these tannins completely prevented growth during a 20-day period. (I) Beltsville, Maryland. 41-B

Preservation of the Quality of Freshly Harvested Produce. Asparagus held for one week at 32° F. in common storage showed a fifteen-fold increase in microbes over comparably refrigerated asparagus held under an atmosphere of six percent CO₂, four percent O₂ and 90 percent N₂. After two weeks the refrigerated asparagus in common storage showed a 200-fold increase in microbial populations over samples held in a controlled atmosphere. Studies were continued on decay control of raspberries, strawberries, and grapes with an experimental vapor-phase chemical. Good control of mold was obtained in the raspberry and strawberry tests, but as applied, the material caused some injury to the fruits. In the case of raspberries this material was inferior to SO₂ in decay control and quality maintenance. Preliminary studies on a single grape variety showed that *Botrytis* decay was completely controlled for one week at 75° F. without an apparent loss in grape quality. (E-fg) New Jersey Agr. Exp. Sta. 41-B

Insect-Resistant Packaging for Dried Fruits. Many of the types of packages in commercial use for dried fruits were tested for their ability to protect the contents against insect infestation. A total of 941 packages was used in one test of 19 kinds of cartons and 17 kinds of visipacks or flexible pouches. After 6 months of exposure to heavy insect infestation the only type not infested was a plastic cup with a heavy polyethylene cover. This package is not used extensively. At least one-third of all other kinds of packages were infested within 3 months. The most resistant cartons were those with a foil overwrap. The best pouch was a polypropylene-cellophane combination. Raisins and figs were attacked more than other fruits. In another test all 5 replications of a laminate with foil between polyethylene films gave complete protection for 12 months. (I) Fresno, California. 41-C

Peach Rootstocks with Increased Resistance to the Javanese Root-Knot Nematodes. The peach rootstock *Nemaguard* made available for testing as

FV 234-1 in 1959 and named in 1961 gave high resistance to one root-knot nematode species and increased resistance to the Javanese root-knot nematode. A derivative of Nemaguard now in advanced testing stages produces most seedlings with immunity to acrita root-knot nematodes and about twice as many seedlings free of the Javanese root-knot nematode as does Nemaguard. This resistance to nematodes has been confirmed in Beltsville tests. (I) Fresno, California.

41-F

Survey of Resistance in Pea Introductions. With the cooperation of the other three Regions, the Northeast Regional Plant Introduction Station, Geneva, New York, published a list of pea (Pisum sativum) introductions having resistance to diseases, insects, and nematodes attacking this crop. (I) Geneva, New York.

42-A

World Bean Collection. A third exploration into Mexico for indigenous varieties of beans yielded 305 collections. These are being screened for seed borne viruses and for resistance to bean root rot (Fusarium), bacterial blights and viruses. (I) Beltsville, Maryland; and Pullman, Washington.

42-B

Non-Chemical Control of Cabbage Looper. A large-scale installation of blacklight insect traps plus cabbage looper sex-pheromone attractant has been made near Red Rock, Arizona, to test the effectiveness of the combination for protecting lettuce from looper damage. Over 400 traps are installed at 1/16-mile intervals around the perimeters of 80-acre lettuce fields on an isolated 2400-acre ranch. The first season's operation is not yet complete but light trap collections of both total loopers and mated female loopers have been substantially lower in the test area than in unlighted "check" fields several miles away. (I) Mesa and Tucson, Arizona; and Riverside, California.

42-C

Relation of Leafhoppers and Aphids to the Transmission of Vegetable Crop Viruses. Aluminum foil laid between cucumber rows in 6 different patterns reduced the average number of alighting aphids from 94 in the check to 2 in some of the treatments with a resultant reduction in virus transmission of 50 percent. In addition, the size of plants in some foil-treated plots were doubled in size and their yield quadrupled apparently due to sunshine enrichment from the reflective surfaces as well as aphid and virus infection reduction. Colored plastic sheets laid in lettuce plots attracted or deterred aphids in a range from 8 or 9 with aluminum and dark blue strips with increasing numbers on light blue, orange, white, black, red, green and pink up to a high of 86 aphids on yellow strips. (E-fg) Wisconsin Agr. Exp. Sta.

42-C

Disease Resistance in Potato. In Maine 48 advance selections were tested for resistance to ring rot, scab, Verticillium wilt, leafroll, net necrosis,

stem-end browning, viruses X, A, and Y, and late blight. Seedling B5415-6 showed resistance to six of these diseases. B5458-6, with excellent yielding ability, had resistance to scab, Verticillium wilt, leafroll, net necrosis, stem-end browning, and viruses X and A. In Washington 91 out of 50,000 seedlings grown in 1966 were selected for increase and evaluation. Seedling 48-1 possesses resistance to leafroll and Verticillium wilt, and has less internal coloration than Russet Burbank. Total yield of 835 cwt. per acre for seedling 48-1 compares well with 671 for Russet Burbank. (I) Beltsville, Maryland; and Washington Agr. Exp. Sta. 421-B

Multigenic Field Resistance to Late Blight. Over 15,000 plants from the seed of 40 family lines were screened in Maine, West Virginia, and Mexico with race 1,2,3,4 of Phytophthora infestans. Two early maturing seedlings, B5090-11 and B5422-9, showed a high degree of multigenic resistance to late blight and over 40 other seedlings having late maturity were rated as very resistant. (I) Beltsville, Maryland; and West Virginia Agr. Exp. Sta. 421-B

Nematode Resistance in Potato. Sixteen out of 24 advance selections were checked for resistance to golden nematode (Heterodera rostochiensis) in cooperation with the New York Station. Several resistant selections had early maturity, multiple resistance to several diseases, and yields and processing qualities suitable for commercial varieties. (I) Beltsville, Maryland; and Cornell Agr. Exp. Sta. 421-B

Disease Resistance in Potato (in Nigeria). Several selections from family line B6377 were tested cooperatively with AID in Nigeria and proved to be highly resistant to the root knot nematode (Meloidogyne spp.). Resistance to late and early blight was also observed in this material. (I) Beltsville, Maryland. 421-B

Field Resistance to Potato Late Blight. An exponential fungicide sprayer was built which delivered spray at 250 psi in concentrations that decreased logarithmically. With this equipment it was found that spray concentration makes little difference in late blight control on a resistant variety like Sebago, but a big difference on a susceptible variety like Dazoc. This adds emphasis to the importance of relatively small varietal differences in field resistance to late blight and to the importance of considering varietal resistance when using fungicides for blight control. (E) Minnesota Agr. Exp. Sta. 421-B

Elimination of Overwintering Hosts of Aphids that Spread Potato Leaf Roll Virus. Tests were initiated to determine the possibility of eliminating the green peach aphid, which spreads leaf roll virus in potato fields, in a non-isolated 315-square-mile area in central Aroostook County, Maine.

Approximately 450 Canadian plum thickets, which serve as alternate hosts of the aphid were found in the area and are being removed. (I) Presque Isle, Maine. 421-C

Application of Predator Eggs in Sprays. Seven-spotted ladybird beetle and Chrysopa spp. eggs were distributed in water or sucrose solution sprays without excessively suppressing hatchability. Chrysopa egg hatch was markedly reduced when applied at a pressure of 30 lb/in.², C. septempunctata egg hatch was reduced when lower spray pressures were used. (I) Orono, Maine. 421-C

Pacific Coast Wireworm Sex Attractant. The presence of a sex pheromone in adult Pacific Coast wireworm females highly attractive to males was demonstrated. (I) Yakima, Washington. 421-C

Aphid Resistance in Potatoes. A survey was conducted of aphid resistance in tuber-bearing Solanum species. (E-fg) Minnesota Agr. Exp. Sta. 421-C

Golden Nematode Resistant Potato Variety Released. A golden nematode-resistant variety, Peconic, was released and it is the first resistant variety to be developed in the United States. Peconic has been yield tested in 15 tests in 6 years in Up-State New York and in 9 tests in 5 years on Long Island. Peconic sets a larger number of tubers than does Katahdin but its yield in tubers over 2-1/4 inches equals approximately that of Katahdin. This smaller size distribution should make a nicer appearance in small packages. The specific gravity of Peconic is higher than that of Katahdin while its reaction to after-cooking darkening is equivalent to Katahdin. (E-fg) New York Agr. Exp. Sta. 421-F

New Disease Resistant Tomato. Tomato trials this year again produced evidence of spider mite tolerance in lines selected for 15 years or more in Hawaii (Oahu). A new variety (Healani) is the first new inbred, determinate type produced here with resistance to vascular browning (physiological type) combined with resistance or tolerance to 7 other diseases. (E-fg) Hawaii Agr. Exp. Sta. 422-A

Tomatoes Resistant to Nematodes and Diseases. F₁ hybrids of the tobacco mosaic virus resistant lines 431 and 390 (Florida) with Nemared are promising, having desirable fruit characters, high production and resistance, especially to TMV, nematodes, fusarium wilt and stemphilium. (E-fg) Oklahoma Agr. Exp. Sta. 422-A

Nematode and Disease Resistant Tomato. The multiple disease resistant line TT135 was released as a new variety under the name Nematex. Because of its wide adaptability and disease resistance, this tomato should find a

place with fresh market growers as well as local gardeners. It is resistant to root knot, Fusarium wilt, grey leaf spot, *Alternaria* collar rot, blossom-end rot, and fruit cracking. (E-fg) Texas Agr. Exp. Sta. 422-B

Soil Microorganism Associations. In greenhouse tests, reductions of root-knot severity of tomatoes were obtained by incorporating residues into infested soil and by applying residues to soil as a mulch. When residues were incorporated into the soil at the rate of four percent by weight, complete control of root-knot resulted. Less, but still significant, control was obtained at one and two percent rates of addition. It appears that there may be two toxins involved with decomposing oat straw residues: One which reduces nematode populations, and another which adversely affects growth of tomato plants. No such tomato growth-inhibiting toxin was demonstrated with alfalfa, orchard grass, or flax residues, but a nematode inhibiting toxin was produced. In field experiments, oat straw, alfalfa hay, and flax residues incorporated into soil at 10 tons per acre reduced nematode infection of tomatoes by 55, 58 and 69 percent, respectively. (E-fg) Tenn. Agr. Exp. Sta. 422-B

Resistance of Tomatoes to Potato Aphid. Tomato seedlings with Lycopersicon esculentum parentage and those of available accessions of L. pimpinellifolium, hirsutum, and hirsutum glabratum were mostly killed by the aphids. Six accessions of Lycopersicon peruvianum showed a high level of resistance. (I) Beltsville, Maryland. 422-C

Investigation of Cowpea Diseases, Resistant Factors, and Production of Resistant Varieties. The release of a new disease resistant cowpea variety of silverskin type, designated Mississippi Silver, was completed. Observations were made on seed production and food production in large fields and were continued on smaller test plots. Field tests were made in various areas of Mississippi on a black-eye strain of cowpea. The results were satisfactory under the conditions of the season but it is difficult to judge whether this strain will perform well over several disparate seasons. Approximately 14,000 individual plants were tested in the greenhouse for resistance to Fusarium wilt and root-knot nematode. Field readings were taken for virus tolerance and plant type in Crowder, Pinkeye, Blackeye and Green varietal types. The usefulness of the work on disease resistant cowpeas may be ascertained by the fact that there was a demand for 300 pounds of seed of Mississippi Silver for production of foundation seed in 1967. (E-fg) Mississippi Agr. Exp. Sta. 424-A

Disease Resistance in English Peas. In greenhouse tests, 65 lines were screened for Fusarium root rot resistance and only one P.I. line (#140165) showed promise as breeding material. (I) Beltsville, Maryland. 424-B

Biological Control of Soilborne Plant Pathogens. Microbiologists and pathologists of the Crops Research Division have discovered that the addition of pure cellulose to soil reduces Fusarium root rot of beans. Cellulose in soil naturally infested with the pathogen does not affect the inoculum density of the pathogen. The investigators have demonstrated that amending soil with cellulose increases the natural fungistatic level of soil to such an extent that resting propagules of the pathogens adjacent to bean roots do not germinate. It was further found that ground newspaper, an inexpensive form of cellulose, was as effective as pure cellulose in reducing Fusarium root rot of beans.

(I) Beltsville, Maryland.

424-B

Disease Resistance in Lima Beans. Green Fordhook 861, resistant to downy mildew, was released in 1966. This variety continues to show promise in commercial plantings in New Jersey. There should be approximately 125,000 pounds of seed produced in 1967 for use by processors in 1968. Baby limas G1 and G2, resistant to the two strains of downy mildew, outperformed Thaxter in 1966 commercial plantings. Frozen samples were identical to Thaxter. Additional hybrids having darker green seedcoats and cotyledons than G1 and G2 are being tested. Jackson Wonder types resistant to the two strains of downy mildew continued to show promise in the 1966 trials by being more productive than Jackson Wonder. (I) Beltsville, Maryland.

424-B

Disease Resistance in Snapbeans. More than 100 lines from the F₁ to F₇ generation were screened for multiple resistance to curly top, common (CBMV) and bean yellow (BYMV) mosaic viruses, Fusarium root rot and horticultural quality in 1966. About 40 advanced generation lines resistant to curly top and common mosaic were tested for quality and the 10 outstanding ones, together with 30 others, will be included in the 1967 preliminary yield trials. The superior lines will be canned and increased for commercial processing trials in 1968. (I) Washington Agr. Exp. Sta.

424-B

Control of Aphanomyces Root Rot of Peas with Soil Amendments. Methyl-containing amino acids, Dexon, and cruciferous amendments suppressed growth of Aphanomyces euteiches, cause of root rot of peas, under greenhouse conditions. DL- β -methylaspartic acid (MAA), DL- β -amino butyric acid, applied to soil surface as a side-dressing one week after planting, and Dexon mixed with the soil at planting gave best control. Cruciferous amendments were slightly less effective than amino acids or Dexon. With the exception of MAA, all treatments were slightly less effective at 27° - 29° C. than at 19° - 21° C. (I) Beltsville, Maryland.

425-B

Biological Control of the Pea Aphid by Introduced Parasites. Releases of the parasite Aphidius smithi; in Idaho indicated that the parasite did establish itself under northern Idaho climatic conditions and one 60-acre field of peas heavily infested with pea aphids exhibited 100 percent parasitism. (E-fg) Idaho Agr. Exp. Sta.

425-C

Resistance of Sweetpotatoes to Insect Attack. Factors involved in sweet-potato resistance to insects are a thick cortex imparting a degree of tolerance and the periderm of most, but not all varieties, which provides protection against insect damage. The flesh of a few varieties is nonpreferred by some insect species either because it lacks a feeding stimulant or contains a feeding deterrent. (I) Charleston, South Carolina. 426-C

Release of Spinach Breeding Lines. Seed increase of the fall-type spinach line S498 was unsatisfactory and is rescheduled for release in the fall of 1967. Two longstanding smooth leaf and two longstanding Savoy leaf lines are being increased for release to seedsmen during the fall of 1967. One longstanding hybrid (America x 276 x 274) will be released as Supercurl this fall. These lines and the hybrid are highly resistant to two races of mildew. (I) Beltsville, Maryland. 427-B

Resistance to Big Vein Virus of Lettuce. At the present time big vein is the most damaging disease of lettuce in the Central-Coastal District of California. Merit, a big vein-tolerant variety, is being used as the resistant parent in the breeding program. Two resistant lines developed from crosses with Merit lacked satisfactory horticultural characters. These lines have now been crossed with four of the leading commercial varieties. (I) Salinas, California. 427-B

Resistance to Mosaic in Lettuce. At Salinas, progress has been made in breeding head lettuce for mosaic resistance. In addition to the resistance found in P.I. 251245 and 251246, another plant introduction from Egypt, P.I. 251247, has some resistance to the virus. Also, a variety from Argentina, Galleya, was found to have a higher level of resistance to the virus than the P.I. numbers mentioned above. These resistant selections have been hybridized with commercial varieties, and some lines are now in the second backcross generation. It is clear that a significant breakthrough has occurred in the effort to develop varieties resistant to lettuce mosaic. Several sources of resistance to the virus have been identified where previously none was available. (I) Salinas, California. 427-B

Cabbage Looper Diseases. Field collections of cabbage looper cadavers from cabbage during the 1966 fall season disclosed 2 distinct classes of fungi, a Phycomycete, Entomophthora sphaerosperma Fresenius, and a Fungus Imperfecti, Spicaria rileyi Farlow. Immersion of cabbage plants in Bacillus thuringiensis suspensions, a bacterial pathogen, reduced oviposition of cabbage looper adults to a greater extent than did spraying. Laboratory experiments with 10 different preparations of Bacillus thuringiensis indicate that all 5 instars of the cabbage looper are as vulnerable to the pathogen as those of the imported cabbageworm. (I) Charleston, South Carolina. 427-C

Cabbage Looper Cytoplasmic Polyhedrosis Virus Pathogen. A cytoplasmic polyhedrosis virus was found infecting cabbage looper larvae. Polyhedra were isolated and purified. The LD₅₀ for the first instar larvae was approximately 1.5 polyhedra per mm² of diet surface area. Fourth instar larvae were less susceptible. Cytoplasmic polyhedrosis virus infection also appeared to affect pupal and adult stages in these studies to find pathogens which may have usefulness in control of pest insects. (I) Riverside, California. 427-C

Effect of Sound on Insect Behavior. A field test was conducted in Blythe and Santa Maria, California, to evaluate pulsed ultrasonic sound for prevention of oviposition by cabbage looper females in lettuce and broccoli fields. Three fundamental frequencies--20, 30 and 40 kc/s--were evaluated. Each frequency was doubly pulsed at a fast (50 msec with 50 percent duty cycle) and a slow (5 sec with a 20 percent duty cycle) pulse rate. Counts of eggs on plants in front of the loud speakers indicated that up to a 50 percent reduction in egg density had been achieved. (E-fg) California Agr. Exp. Sta. 427-C

Attractants for Cabbage Looper Males. The trans isomer of 7-dodecenyl acetate and several other related compounds were prepared and evaluated as attractants for cabbage looper males. None were as effective as the female sex attractant, cis-7 dodecenyl acetate. Simpler procedures for the synthesis of this compound were developed. (E-fg) Alabama Agr. Exp. Sta. 427-C

Powdery Mildew and Crown Blight Resistance in Melons. A powdery mildew-resistant and crown blight-resistant honeydew breeding line exhibited superior performance to commercial Honeydew in both the presence and the absence of powdery mildew in advanced trials in Arizona, California, and Texas. It is in the process of mass increase for release. (I) Arizona Agr. Exp. Sta., California Agr. Exp. Sta., and Texas Agr. Exp. Sta. 428-B

Resistance to Alternaria in Melons. Verification of a high level of resistance in cantaloups has been obtained in greenhouse tests and resistant breeding lines have been distributed to collaborators in the Southeast. Stock C433 is particularly notable. (I) Charleston, South Carolina. 428-B

Insect Resistance in Cucurbits. Four species of Cucurbita with eight included cultivars were seeded and allowed to develop without pesticide treatments. Based upon plant survival and percent of survivors bearing fruit, C. pepo was superior to all other species. Floral morphology is a definite factor influencing both bees and cucumber beetles with greater numbers occurring in the larger flowers with deeper corollary. There is a differential attractiveness of cultivars to the two species of cucumber beetles. There is a tendency for the honey bee and spotted cucumber beetle to be associated and a similar tendency for the squash bee, Peponapis, and the striped cucumber beetle to

occur together; Differential attractiveness of cultivars to pollinators is less pronounced than it is to cucumber beetles. (E-fg) Indiana Agr. Exp. Sta.

428-C

Insect Resistance in Pumpkin. Genetic studies of squash bug resistance in Cucurbita pepo L. were completed with resistance found as being a multigenic additive character and partially dominant over susceptibility and controlled by an estimated 3 to 5 gene pairs. A significant positive squash bug feeding response was obtained to C. pepo plants grown in P, K, S, and N with the latter being the least preferred compared with complete media. (E-fg) Kansas Agr. Exp. Sta.

428-C

Resistance in Wild Pepper to Cucumber Mosaic. Resistance to the most serious aphidborne cucumber mosaic virus has been found in two wild pepper selections. Resistance is inherited as a recessive character. Crosses have been made with susceptible Bell and paprika-pepper types. (I) Beltsville, Maryland.

429-B

Disease Resistant Pepper Variety. A new pepper variety named Yolo Y was released to commercial seed producers in May 1966. This variety carries resistance to potato Y virus and tobacco mosaic virus and has produced consistently higher yields than standard varieties in plantings exposed to either or both viruses. (E-fg) Florida Agr. Exp. Sta.

429-B

Earworm Resistant Variety of Sweet Corn. A new variety of sweet corn (Gold Pack) demonstrated resistance to corn earworm. Any increase in ear exposure by loosening or removing husks resulted in a marked increase in earworm and sap beetle infestation. (E-fg) North Carolina Agr. Exp. Sta.

429-C

Identification, Etiology and Control of Virus Diseases of Deciduous Fruit Trees. New varieties of cherries, Chinook and Rainier, are symptomless carriers of Lambert Mottle (LM) disease; Shiro-plums are resistant and May Duke cherries are equally susceptible to LM and necrotic rusty mottle (NRM) disease. It appears that Starking Hardy Giant cherry is also susceptible to LM virus. Separation of LMV and Prunus ring spot virus (PRSV) was achieved on Prunus serotina. Trees inoculated with a purified culture of LMV tested free of PRSV on Shiro-fugen cherry. Some Bing cherry trees inoculated with LMV became resistant to subsequent infection with NRM virus. All tested varieties of cherries were susceptible to short stem virosis; however, apples, pears, plums and peaches were resistant. Various abnormalities shown by trees in a cherry hardiness test appeared to be genetic in nature. (E-fg) Montana Agr. Exp. Sta.

43-B

Influence of Time of Pruning on Carbohydrate Reserves and on Incidence of Bacterial Canker in Peach. Pruning of peach trees in South Carolina during October or November followed by spray inoculation with a virulent strain of Pseudomonas syringus, the bacterium causing bacterial canker, can result in death of trees. Trees sprayed with an avirulent strain or pruned when fully dormant and sprayed with a virulent strain showed little or no damage. Inoculation throughout the dormant period showed similar movement of the bacteria. Early pruning depleted carbohydrate reserves of the tree and rendered it susceptible to cold damage. As a consequence, a recommendation of pruning only during the fully dormant stages has been adopted by South Carolina. (I) Clemson, South Carolina. 431-B

Scald Control with Hot Water Dips. Storage scald on Delicious apples was controlled more effectively with a 5-minute dip at 120° F. than with a 30-second dip at 130°, which was most effective for Stayman apples. (I) Beltsville, Maryland. 433-B

Tests with Polyflavonoids for Apple Mite Control. Tests with polyflavonoids have confirmed earlier findings that these materials may act as mite suppressants. Iron polyflavonoid was the most active of the group tested. A combination of all of the metallic polyflavonoids (Fe, Mg, Mn, Zn, and Cu) was more effective than iron polyflavonoid alone. Foliar applications of these materials may fit into integrated control programs if their effect on predatory mites proves to be minimal. (I) Kearneysville, West Virginia. 433-C

Codling Moth Granulosis Virus. Codling moth larvae infected with granulosis virus when the larvae are 15 days old, produced the highest yield of virus particles at the time of larval death. (I) Vincennes, Indiana. 433-C

Sterilization of Insects with Tepa. In preparation for field tests experiments were carried out to develop effective, safe ways of using tepa to sterilize insects for subsequent release. Several methods of applying tepa to codling moths were compared. Application of the tepa in an aerosol appeared most adaptable to treatment of large number of the insects. The persistence of tepa on codling moths and drosophila was determined to make sure that no hazardous residues would remain on treated insects that would be released. Preliminary tests also were made of the use of dilute tepa solution on wicks in insect feeders as a means of treatment. (I) Yakima, Washington; Beltsville, Maryland; and Tifton, Georgia. 433-C

Parasitism of Woolly Apple Aphid by Aphelinus mali reached a peak of 63 percent by early October 1966 in a 15-acre experimental apple orchard receiving sterile male releases in lieu of insecticides for control of codling moth. This important parasite has declined in recent years with the wide-

spread use of insecticides, but it has now been demonstrated that it is capable of rapid recovery in the absence of insecticide treatments. (I) Yakima, Washington. 433-C

Equipment for Mass Rearing of Insects. Equipment was developed and briefly tested for mass rearing and releasing of sterile male codling moth to control native infestations. Equipment included: (1) Pupae sex separating machine, through size difference between sexes, using gradual larger space between two rotating incline rolls; (2) electronic sorter for separating mature from other pupae by reflection difference in infrared region; and (3) flight mill for determining vigor of moths exposed to gamma radiation--a photo-electric counter records rotations of moth attached to a pivot arm flying in horizontal circle. (I) Yakima, Washington. 433-C

Chemistry of Sex Attraction. Histological studies on the female abdomen of red-banded leafroller have revealed the location of the sex pheromone producing gland, which has subsequently been excised from thousands of females. The glands are extracted with ether or methylene chloride and subjected to column chromatography. Active fractions are determined by bioassaying with the males. Bioassay studies have shown that the time of highest biological activity is at 9 AM with 4-5 day-old males. A concentration:response curve constructed from bioassay data shows that the extract from one female can be diluted a million times and still elicit a male response. The active fractions obtained by column chromatography are now being purified by gas-liquid chromatography. Traps baited with crude pheromone extracts were set out in orchards this past summer and were quite successful in attracting large numbers of males. Only red-banded leafroller males were trapped which indicates the pheromone to be species specific. (E-fg) New York State Agr. Exp. Sta. 433-C

Integrated Control in Apple Orchards. About 8,000 acres of apple orchards were included under integrated control programs. The advantages of this method of controlling mites are improved control by a more permanent method, reduction of spray costs by as much as 60 percent, reduction in phytotoxicity, and reduced pesticide residues on the fruit at harvest. The improved control applies to those areas where mite resistance to pesticides is a problem. Since resistance is a major factor in the continuing mite problem, a mite control method which circumvents resistance has long been sought. (E-fg) Washington Agr. Exp. Sta. 433-C

Mite Resistance in Apples. In tests for resistance to two-spotted mite, Tetranychus telarius L., 5 apple species and segregates were identified with populations only 1/4 to 1/5 of the highest. These species and segregates were also among those which appeared most resistant to the European red

mite in previous tests, indicating the possibility of screening for resistance to both insects by artificial infestation with T. telarius alone. (E-fg) Illinois Agr. Exp. Sta. 433-G

The Biology of Certain Nematodes Associated With Root Diseases of Declining Stone Fruits. The effects of pure populations of Meloidogyne hapla and Pratylenchus minyus alone and in combination with Fusarium spp. were studied in tests with Prunus mahaleb. M. hapla successfully colonized P. mahaleb only under certain circumstances. Apparently the plants must be predisposed to attack since colonization and galling failed to occur when young seedlings were exposed to a pure population of M. hapla from tomato. However, when M. hapla were introduced in combination with Fusarium spp. and P. minyus a few males and females matured to the point where gelatinous egg masses were produced, and spindle and terminal galling occurred. No M. hapla larvae penetrated tomato seedlings planted back into the soil in which the P. mahaleb seedlings had grown. (E-fg) Utah Agr. Exp. Sta. 436-F

California Red Scale Sex Pheromone. Female sex pheromone of the California red scale collected as a cold-trap condensate and as extracts of homogenized whole females are being shipped to Beltsville, Maryland, for purification, identification, and eventual synthesis of the pheromone. Of the fractions returned to Riverside and bioassayed for male response, 3 were highly attractive and their properties indicate the pheromone to be an unsaturated ester containing at least 2 double bonds. (I) Riverside, California. 44-C

Introduced Parasite Suppresses Florida Red Scale. Aphytis holoxanthus has become the dominant parasite controlling Florida red scale in Florida. A survey of 104 commercial groves throughout the citrus producing area from February 20 to June 8, 1967, showed that Florida red scale did not occur in economic numbers in any of the groves sampled. Aphytis holoxanthus has practically replaced Pseudhomalopoda prima as the dominant parasite of this scale. Formerly, the Florida red scale was the number two armored scale problem in Florida. (I) Orlando, Florida. 44-C

Citrus Red Mite Virus Attack Texas Citrus Mite. The citrus red mite virus can be transmitted to the Texas citrus mite. Efficiency of the virus against the latter was equal to that against the citrus red mite. Transmission tests against the citrus rust mite were negative. (I) Orlando, Florida. 44-C

Biological Control of Brown Soft Scale. Six species of brown soft scale parasites were introduced from California and released in Texas Rio Grande Valley citrus groves infested by brown soft scale and in tree cages during the year. These were: Encyrtus lecaniorum and Metaphycus stanleyi (currently being reared in the insectary), Metaphycus luteolus, Coccophagus

cowperi, C. scutellaris, and Diversinervus elegans. First generation offspring of E. lecaniorum and M. leteolus have been recovered. (I) Weslaco, Texas. 44-C

Blueberry Insect Investigations. Bud mite on blueberries has been almost completely eliminated in experimental plots by three successive years of thorough cane pruning in late summer followed by light twig pruning in the winter. Putnam scale infestations are also reduced by this type of pruning. (E-fg) New Jersey Agr. Exp. Sta. 452-C

Biological Control of Spider Mites on Strawberries. Biological control of the two-spotted spider mite, Tetranychus urticae Koch, on strawberry was investigated in southern California in 1965-66 with emphasis on integration with chemical control of pest species. Releases of the predaceous mite, Phytoseiulus perimilis Athias-Henriot, were made in March at the rate of 384,000 per acre, following applications of Thimet in August and November and Morocide in February. The two-spotted spider mite population was reduced by 31 and 27 percent in the two Thimet plots, 23 percent in the Morocide plot, and 14 percent in the check plot where P. persimilis was released compared to that where they were not. Strawberry yields were increased by 28, 27, 1, and 21 percent, respectively. Removal of the old, lower, mature strawberry leaves early in January reduced the two-spotted spider mite population by 55 percent during January and February. (E-fg) California Agr. Exp. Sta. 452-C

Development of Strains of Strawberries Resistant to Spider Mites. Marked differences in severity of spider mite feeding damage occurred on strawberry varieties and seedling crosses in greenhouse tests conducted at normal daylight periods in the winter. Progeny of crosses between two resistant parents were generally more resistant than were progeny of selfed-resistant plants or resistant X susceptible parents. (E) University of Kentucky. 452-C

Strawberry Varieties Resistant to Spider Mite Attack. Three of the 30 strawberry varieties tested had considerably lower two-spotted spider mite populations than the others. The variety Shasta had the highest mite population. (I) Riverside, California. 452-C

Aluminum Foil Mulches Effective Against Thrips in Roses. Aluminum foil soil mulches on rose plants effectively prevented infestations of flower thrips in rose flowers. (I) Beltsville, Maryland. 461-C

Breeding Fire Blight and Scab-Resistant Pyracantha (Firethorn). The 210 accessions of Pyracantha species and cultivars have been evaluated for fire blight and scab resistance. Included in the collection are a number of clones

from foreign sources which provide potential germ plasm for the development of superior cultivars. Hybridization of critically evaluated parental clones has yielded more than 15,000 seedlings which will first bear fruit this season. Among these, a number of selections have already been made for evergreen foliage and disease resistance, but progeny testing must be deferred until fruit has been observed. Combined with the breeding program are genetic inheritance studies on fruit color, thorns, and disease resistance.

(I) National Arboretum, Washington, D. C.

462-B

Breeding Mildew Resistant Lagerstroemia indica (Crapemyrtle). From the evaluation of the 250 Lagerstroemia indica cultivars and selections, 20 of the more mildew tolerant forms were selected for hybridization with L. fauriei and L. subcostata, small-flowered, fine-textured foliage species native to Japan that are resistant to mildew. L. fauriei is a hardy species which possibly could contribute genes for hardiness, that would extend the range of L. indica to a point north of Washington, D. C., the present approximate geographic limitation. Several thousand gallon container plants from 1966 crosses will be field space planted next season, and the seedlings from the 75 crosses made in 1967 will be greenhouse grown. (I) National Arboretum, Washington, D. C.

462-B

Viburnum Cultivars Released. Ten Viburnum cultivars recently named and released incorporate desirable growth habit, heavy flowering and fruiting characteristics, with foliage resistant to bacterial leaf spot. The cultivars released are: V. x rhytidophylloides 'Alleghany', V. dilatatum 'Catskill', V. x carlcephalum 'Cayuga', V. dilatatum 'Iroquois', V. x burkwoodii 'Mohawk', V. lantana 'Mohican', V. (dilatatum x lobophyllum) 'Oneida', V. sargentii 'Onondaga', V. sieboldii 'Seneca', and V. sargentii 'Susquehanna'. All 10 cultivars are adaptable for cultivation under diverse climate and soil conditions, and have been hardy at Ithaca, New York, Zone 5b. 'Mohican' is hardy also in Zone 4, while 'Onondaga' and 'Susquehanna' are hardy in Zone 5. (I) National Arboretum, Washington, D. C.

462-B

Pyracantha (Firethorn) 'Shawnee' Released. 'Shawnee' was selected for its abundant inflorescences of glossy, clear yellow to light orange fruits that have an ornamental effective period up to 7 months; foliage that is semi-persistent; dense branching; and resistance to fire blight and scab. The leaves, which are a glossy, dark green and fine-textured, are semi-persistent in Washington, D. C., but in a milder zone would probably be evergreen. Bird damage to fruit has been insignificant or none, while other nearby plants have been stripped of fruit. The cultivar can be readily propagated by softwood or hardwood cuttings. (I) National Arboretum, Washington, D. C.

462-B

Lagerstroemia indica (Crape myrtle) Cultivars Released. Powdery mildew infects shoots and leaves of Lagerstroemia to disfigure the plant and prevent flower bud development. Four cultivars with high mildew tolerance have been named and released. 'Catawba' has dense, globose, medium growth habit; glossy, dark green foliage; abundant, dark purple inflorescences. 'Conestoga' has open growth habit; long, tapered inflorescences; early flowering; florets medium lavender to pale lavender, creating a multiple-colored inflorescence. 'Potomac' has upright growth; numerous, large terminal, clear medium pink inflorescences. 'Powhatan' has compact, medium growth habit; glossy, heavy foliage; abundant, compact, medium purple inflorescences. (I) National Arboretum, Washington, D. C. 462-B

Biological Control of European Elm Bark Beetle. Many of the native natural enemies of Scolytus multistriatus, the European elm bark beetle or principal vector of the Dutch elm disease, have been collected and identified. An European parasite, Dendrosoter protuberans, shows great promise as a potential control agent. It has been successfully propagated at Michigan State University and released. Attempts were made to systematically collect and identify nematodes parasitic on the European elm bark beetle and a single nematode species Parasitaphelenchus oldhami Ruhn, was found. In one location this nematode was found in 86 percent of the beetles dissected. Second generation beetles were infested by contamination with first generation adults. (E-fg) Michigan Agr. Exp. Sta. 463-C

Biological Control of Plant Feeding Mites. The predatory mite Phytosiulus persimilis can be used as a means of controlling leaf feeding mites in private and commercial greenhouses where specific insecticides, such as Sevin and DDT are not used in a regular spray program. Fungicides had no harmful effects on either host mites or P. persimilis. (E-fg) Delaware Agr. Exp. Sta. 464-C

Hickory Shuckworm Sex Pheromone. A strong male attractant which also elicits male mating behavior was extracted from virgin female hickory shuckworm moths. (I) Albany, Georgia. 471-C

Pecan Weevil Sterilization Studies. Mortality of pecan weevil larvae irradiated with cobalt 60 at 62,500 r was 48 percent in 23 days, and 18 percent or less at 12,500, 2,500, and 500 r. (E) Texas A&M University. 471-C

Pecan Insects--Light Traps. Blacklight traps were installed in an isolated 10-acre pecan grove near Sasser, Georgia, to determine the effectiveness of protection against hickory shuckworm, pecan leaf casebearer and pecan nut casebearer. With a good nut crop fully formed and hardening, no significant insect damage has yet occurred. The population of hickory shuckworm remains substantially lower than that in groves a few miles away. (I) Albany, Georgia. 471-C

Biological Control of Olive Scale. An evaluation was made of the effectiveness of the introduced parasites Aphytis maculicornis and Coccophagoides utilis for control of olive scale in 1,000 acres of olive groves. Olive scale densities and fruit-marking levels were above acceptable limits only in groves in which C. utilis had failed to become well established. All data available confirms earlier findings that both species are essential to an outstanding control effect. (E-fg) California Agr. Exp. Sta. 48-C

Forests

Ecology of Forest Tree Diseases and Wood Deterioration. Genes for a significant improvement in resistance to Fusiform rust were shown to exist in the native loblolly pine and will provide a basis for practical gain in this trait. Results of a study with 54 controlled- and 48 open-pollinated crosses showed that: (a) Variation in disease susceptibility is under genetic control; (b) this control is stable under a variety of environmental conditions; and (c) susceptibility to the disease is greater under conditions of high soil fertility. Other studies of factors influencing deterioration of wood in houses have shown that wood is not being used as effectively as it should be in residential constructions. (E-fg) North Carolina Agr. Exp. Sta. 5-A

Pathology of Wilt Diseases. The development of American elms resistant to the Dutch elm disease has involved irradiation with thermal neutrons of seed produced from various crosses and open pollinated varieties. Seedling propagation, root-cuttings, and shoot-cuttings are being utilized to increase nursery stock. A cooperative interstate project is now in progress involving crosses of various clones of American elm and seed increase of various stocks of elm. Ten additional Dutch clones (19 trees) were imported and placed in quarantine: 17 clones are now in quarantine (32 trees surviving). (E-fg) Massachusetts Agr. Exp. Sta. 5-B

Fomes annosus Root-and Butt-Rot of Pinus echinata. Data collected at monthly intervals on levels of Fomes annosus airborne and foliage trapped inoculum and infection of freshly cut pine stumps showed marked seasonal differences. All reached a peak in the winter months, then a June to August seasonal low--though with stump infection, rates as high as 10 percent. Of three stump protectants applied 1 to 3 days after felling, urea gave the most consistent protection, though none provided absolute control. Studies on the extent of bole invasion by the fungus indicate that it is present continuously to 4 foot height in dead and 3 feet in living shortleaf pine. Nutrition studies showed that the fungus can utilize a wide variety of carbohydrates as sources of carbon. (E) School of Forestry, University of Missouri. 5-B

Fusiform Rust of Slash Pine. In September 1966, cones were collected from the remaining disease-free slash pine trees in a plantation that had been rogued three years ago to remove the 90 percent of trees infected with southern fusiform rust. Seedlings obtained will be exposed to fusiform rust to determine the relative inherent resistance passed on by these parents. Seeds were also obtained from slash pines judged superior in growth and form, and seedlings from these sources will also be exposed to fusiform rust to determine value of the parents for use in a breeding program for improved rust resistance. (E-fg) Florida Agr. Exp. Sta. 5-B

Heat can Replace Fumigation in Control of Oak Wilt. Fumigation with methyl bromide has killed all of the fungus in oak wilt infected logs prior to shipment in repeated tests. Results of initial trials in which logs are heated by hot air or hot water dip suggest that heat alone, well below levels that would cause log degrade, may be as effective as fumigation. All of the fungus in infected logs have been killed by 24-hour exposure to 130° F. in air or 110° F. in water, and by 48-hour exposure to 110° F. in air or 100° F. in water. Further experimentation is under way. (I) Delaware, Ohio. 5-B

Seasonal Cutting May Control Annosus Root Rot. In a laboratory study of the influence of temperature on the growth and survival of *Fomes annosus* in wood it was found that the optimum growth rate occurred at 24° C. and no growth occurred at 35° C. Actively growing mycelium in wood chips was killed in two hours at 40° C. Preliminary data revealed that stump surface temperatures near Durham, North Carolina, reached 40° C. or higher for two or more hours in over half of the days from May to August. Based on this information, tests of seasonal thinning as a practical means of reducing losses from annosus root rot are under way. Because of high temperatures on the stump surfaces from April through September, thinning operations during this period should result in lower incidence of disease than those done during autumn and winter. (I) Durham, North Carolina. 5-B

Tree Breeding Produces White Pine Resistant to Blister Rust. Initial test results show that certain western white pine field candidate trees in Washington and Oregon, and sugar pine trees in Oregon and California, have the ability to pass 50 to 70 percent resistance to their first generation progeny. Some 324 potential resistant field candidate Eastern white pine trees were selected on National Forest, and State and private lands in the Lake States. Collected pollination on 198 of these trees has been made so that resistance in their progeny can be determined. (E) States of Oregon, Washington, California, Michigan, Minnesota and Wisconsin. (I) Portland, Oregon; San Francisco, California; and Milwaukee, Wisconsin. 5-B

Natural Resistance in Control of White Pine Blister Rust. A study of the comparative performance of clonal and seedling lines from selections of

blister-rust-free trees revealed that 4 percent of grafts from rust-free lines became infected whereas 89 percent of control seedlings became infected under the same external conditions. Most rust-free western selections in this Idaho study were genotypically as well as phenotypically resistant. Performance of selfed lines indicated that resistance probably is not controlled by single recessive genes. In a related study, results indicate that selection of healthy trees in heavily infected wild stands or nursery seedbeds is a highly productive process which will lead to relatively rapid gain in resistance per generation of breeding. (I) Moscow, Idaho. 5-B

Search for Biological Controls of Annosus Root Rot. In Poland, several hundred fungal isolates were made from pine litter, soil, rhizosphere, roots, and stumps in stands with and without F. annosus infections. For the 15 most frequent isolates in each group their influence on the growth of F. annosus in culture is being determined. (E) Poland, P.L. 480. 5-B

Successional Ecology of Soil Organisms. A huge landslide, falling from far above timberline on Mount Rainier in Washington in 1963, covered the floor of a montane valley with nearly virgin soil. This provided a unique opportunity to study successional ecology of soil organisms in a forested zone. Sampling and analysis of soils over 2-1/2 years reveals marked differences in microorganisms and in carbon and nitrogen content between the avalanche soil and nearly 70-year-old glacial moraine soils. Future studies should yield knowledge of how to manipulate soils and organisms for biological control of root diseases. (I) Corvallis, Oregon; and (E) Oregon State University. 5-B

Biological Control of Mistletoe a Possibility. The rust Uredo phoradendri is a widespread but rather uncommon parasite of various mistletoes, Phoradendron spp. It was found recently on Phoradendron balleanum var. pauciflorum, a parasite of Abies concolor in Baja, California. The report was the first on this host and the first from Mexico. Knowledge of the host range and distribution of the parasite is important in studies toward its use as a biological control agent. (I) Berkeley, California. 5-B

Proper Scheduling can Avoid Human Allergy Problem. Life cycle studies of the fungus, Cryptostroma corticale, a common saprophyte of sugar maple and the cause of a serious allergy in humans when its spores are inhaled, have provided information on factors affecting spore production on stored pulpwood. Using this information, wood users can arrange schedules to avoid processing during periods of heavy sporulation by the fungus. This should eliminate the problem which has occurred in several Lake States paper mills. (I) Marquette, Michigan. 5-B

Multiple Types of Natural Resistance to Western Gall Rust Observed. Two methods have been developed for inoculation of ponderosa pine with western gall rust. One method successfully inoculated 92 percent of saplings enclosed in a plastic tent. A second method inoculated current-season growth on arbor-etum trees. Multiple kinds of resistance to western gall rust in ponderosa pine are suggested by variations in type and rate of gall formation after experimental inoculation. (I) Berkeley, California. 5-B

Resistance Mechanism Against Poria weirii Root Rot. A possible biochemical explanation for the resistance of red alder to Poria weirii infection and the high susceptibility of Douglas-fir has been advanced. Alder tissue has a high activity of the enzyme polyphenol oxidase and a high content of phenolic compounds. P. weirii also secretes the enzyme, and this added amount of enzyme speeds oxidation of the phenols to form materials toxic to the fungus. Douglas-fir lacks both the polyphenol oxidase system and the phenols that are made fungi-toxic so infection can take place. These findings may aid the search for Poria-resistant strains of Douglas-fir. (I) Corvallis, Oregon; and (E) Oregon State University. 5-B

Biological Control of Poria weirii Root Rot. Many soil microbes that inhibit P. weirii thrive on nitrate whereas P. weirii cannot use nitrogen for lack of the enzyme nitrate reductase. Nitrogen-fixing alder root nodules result in high nitrate levels and increase the kinds and numbers of Poria-inhibiting organisms. (I) Corvallis, Oregon; and (E) Oregon State University. 5-B

Selected Slash Pines Transmit High Resistance to Southern Fusiform Rust. Studies in Mississippi have shown resistance to rust is strongly inherited and that a number of resistance-transmitting parents can be found. Crosses between the better slash pines gave progeny with only 10 percent infection after intensive disease inoculation in contrast to the 90 percent infection of woods-run seedlings. (I) Gulfport, Mississippi. 5-B

Progeny Testing Efficiency for Western White Pine Blister-Rust Resistance Greatly Improved. It has been determined that for western white pine an estimate of general combining ability for resistance can be obtained with a single set of crosses using a mix of 10 or more pollens instead of the usual 4 sets of single crosses. Now only about one-fourth as many pollinations are needed, and the numbers of seedlings to be grown, inoculated and examined has been greatly reduced. (I) Moscow, Idaho. 5-B

Fusiform Rust Losses in Loblolly Pine can be Reduced by Proper Choice of Seed. Ten-year data from 15 sources of loblolly pine grown in 13 widely separated plantations over the south display well-defined patterns of variation. Western and northern sources tend to be more resistant to fusiform

rust, thus proper choice of seed origin can reduce damage in high-hazard areas. In a complementing study in Georgia where individual families within sources were studied in a high-hazard area, the best families had 4 to 6 times as many rust-free trees as did the poorer families. Resistance can be intensified by breeding among the best trees from each desired source.

(I) Gulfport, Mississippi; Macon, Georgia.

5-B

Management Control of Red Oak Borer. Results in eastern Kentucky plots over the last 6 years indicate that the red oak borer can be controlled through stand manipulation. Examination of stands left after logging disclosed that slower growing trees are most preferred by the borer. Results based on three complete generations of the borer over 6 calendar years clearly showed that the incidence of borer attack decreases as annual diameter growth increases, regardless of tree diameter class. Thinning operations during the second (non-attack) year of the red oak borer's life cycle have produced the following results: (a) Thinning reduced the number of susceptible stems present for attack; (b) increased vigor induced by release is expected to reduce the number of successful beetle attacks as soon as the trees begin growing at a more rapid rate; and eventually (c) as the stand begins to stagnate, a return to pretreatment borer population levels would be expected.

(I) Delaware, Ohio.

5-C

Termite Trail Substance. A gland known to secrete an attractant which enables termites to follow trails made by other termites has recently been investigated. So far the exact role of the attractant in termite ecology is unknown, but if it is used to lead termites to or locate a food source it may possibly be utilized in control measures. Studies are in progress to chemically identify the secretion. (I) Gulfport, Mississippi.

5-C

Proper Timing of Thinning Reduces Bark Beetle Losses. *Ips pini* frequently is an important cause of tree mortality in recently thinned stands of ponderosa pine in Oregon and Washington, particularly where thinnings are made in the spring and early summer. Consequently, forest managers have generally scheduled thinning operations in the late summer, fall, and winter. However, recent rapid expansion of thinning programs has created the need to thin year-round. Most ips-caused mortality seems to occur in stands that are stagnated or approaching stagnation when thinned. This observation means that (1) Restricting thinnings to certain periods of the year may be necessary only in stagnated stands, and (2) thinning can be done safely throughout the year in non-stagnated stands. (I) Portland, Oregon.

5-C

Chemosterilants Arrest Spruce Budworm Reproduction. Five chemosterilants were evaluated against male spruce budworm pupae in 1966. Tepa and metepa showed promise in arresting reproduction by more than 99 percent, but

tretamine, apholate, and hempa were not as effective. Metepa-treated males reduced egg production as well as percent hatch when mated to normal female moths. The most effective time for treatment of the males is during the first 24 hours after pupation. (I) St. Paul, Minnesota. 5-C

Nematodes Reduce Bark Beetle Egg Production. Studies on Contortylenchus reversus, a parasitic nematode of several bark beetles, revealed that egg production of infected host females is reduced by nearly one-half. These nematodes may also be an important cause of larval mortality because they have been recovered abundantly from the larval galleries and are known to readily attack the larvae in the laboratory. (I) Albuquerque, New Mexico. 5-C

Woodpeckers Control Engelmann Spruce Beetle. Woodpeckers appear to be the key natural control agents of the Engelmann spruce beetle. In an area having an endemic population of Engelmann spruce beetles, 3.1 birds were present per 100 acres the first year of study and 2.2 birds the second year. The diet of 24 northern three-toed woodpeckers was found to consist largely of roundheaded borers and bark beetles, accounting for almost 80 percent of their food supply. Aggregation of the woodpeckers in an area of high food source may be as many as 270 per 100 acres. The major problem in managing woodpecker populations is to determine how to provide the birds with a supply of non-injurious bark beetles and borers between outbreaks. (E) Fort Collins, Colorado; Colorado Agr. Exp. Sta. 5-C

Combined Virus-Bacillus Spray Controls Tent Caterpillar. The experimental application of a nuclear-polyhedrosis virus and Bacillus thuringiensis by helicopter resulted in a high rate of infection of colonies of the Great Basin tent caterpillar, Malacosoma fragile incurva. Populations were 95 percent lower in the sprayed area than in the unsprayed area the year following treatment. The studies were conducted at Sabino Canyon, a highly used recreational area outside Tucson, Arizona. This is significant in that the use of microbial agents might be a good alternative in recreational and other areas where use of chemical insecticides is undesirable. (I) Albuquerque, New Mexico. 5-C

Western Pine Beetle Attractant Synthesized. There is a great need for better ways to control tree-killing bark beetles. One of the important new approaches is the development of attractants. This involves finding out how the beetles locate each other in the forest and also how they find suitable trees to attack. A major step forward was recently made by Forest Service-supported scientists at the University of California and Stanford Research Institute in the identification and synthesis in the laboratory of a major component of the western pine beetle sex attractant. This is an extremely

important finding because the western pine beetle is the major killer of mature ponderosa pine sawtimber in the West. As such it is responsible for the destruction of an estimated 1 billion board feet of timber annually. Much still remains to be done to bring the technique to the stage at which it can be used in the field, but this discovery points toward the time when we will be able to use the insects' own scents to lure them to destruction. (E) University of California and Stanford Research Institute. 5-C

Black Hills Beetle Attracted to Freshly Infested Bolts and Trap Trees.

Further information was obtained on different aspects of attraction of trees to the Black Hills beetle in the central Rocky Mountains. Field tests in 1966 demonstrated that: (1) The forced attack must be accurately coordinated with the natural emergence of the wild population; (2) trees of low vigor should be used as trap trees to avoid pitch out and an unsuccessful release of attractant; and (3) the cages should be recharged with new beetles if fine boring dust is not produced. Bolts infested in the laboratory and fastened to green trees have also been effective attractants. (I) Fort Collins, Colorado. 5-C

Virus-Spray Formulations Improved for Douglas-fir Tussock Moth. At Corvallis, Oregon, pilot-scale production methods were developed in cooperation with private industry for a nuclear polyhedrosis virus of the Douglas-fir tussock moth. Production costs were high but it is believed that large-scale production can lower costs to an acceptable level. In addition, procedures were developed for quality control of industrial batches of virus. Water-base formulations for virus sprays were developed which appear to be far superior to any used previously. These formulations are rainfast, compatible with virus and host insect, and maintain the pathogen in suspension. (I) Corvallis, Oregon. 5-C

Sawfly Sex Attractant has Limited Range. Some 19,000 female sawflies were used to collect the sawfly attractant material. The chemical was purified and analyzed, and some 30 candidate compounds in the molecular weight range of the material have been synthesized. Similarly, about 8,500 female white fir sawflies were collected for attractant studies. Field studies indicate that the sex attractant compounds do not volatilize over great distances. This suggests that male sawflies must be close to females before they respond to the attractant. (E) Madison, Wisconsin; Ag. Exp. Sta. 5-C

Method for Testing Resistance to White Pine Weevil Being Perfected. Researchers at Pennsylvania State University supported by a Forest Service grant have found favorable indications that small trees can be used to screen trees for resistance. The behavior of the insects during the host findings and feeding was typical; the weevils were able to discriminate among three

species; and useful levels of selection appear possible. Refinement of this procedure will permit stepped-up testing of progenies in breeding weevil-resistant eastern white pine. (E) Pennsylvania State University. 5-C

Biological Control of Gypsy Moth Larvae. Nuclear polyhedrosis virus was evaluated for control of gypsy moth larvae. A series of concentration-, dose-, and time-mortality tests indicated that the first-instar larvae was the most susceptible and the third-instar the least. The relative susceptibility of all larvae instars to nuclear polyhedrosis virus indicates potential field control of gypsy moth. (E-fg) Connecticut Agr. Exp. Sta. 5-C

Control of Pine Sawfly. Progress was made toward breaking the diapause of the pine sawfly, Neodiprion taedae linearis, by exposing the cocoon to varying photoperiods. Several thousand larvae sprayed with the virus obtained in 1965 resulted in 100 percent mortality. Identification of parasites of the sawfly continues. (E-fg) Arkansas Agr. Exp. Sta. 5-C

Biological Control by a Predaceous Ant. A study of the predaceous ant Formica obscuripes and its potential use as a biological control agent has provided data on the nests, food habits, activity, foraging range, distribution, and density. Direct observations have indicated that it will attack various larva, leafhoppers, and other potentially injurious pests of jack pine and Scotch pine. (E-fg) Michigan State University. 5-C

Control of Utah Juniper. Utah juniper can be controlled by a twice-over helicopter application of Tordon at 2 pounds per acre in 10 gallons of water. Mechanical clearing of juniper trees was followed by a marked invasion of shrubs, forbs, and grasses. Winterfat planted in the clearing in 1965 has proven adapted to the site and to early utilization by game. (E-fg) University of Wyoming. 5-D

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TARGET III

TO DEVELOP SAFER AND MORE EFFECTIVE PESTICIDE USE PATTERNS,
FORMULATIONS, AND METHODS OF APPLICATION; AND IMPROVED
METHODS FOR DETECTING, MEASURING AND ELIMINATING OR
MINIMIZING PESTICIDE RESIDUES IN PLANTS, ANIMALS
AND THEIR PRODUCTS, AND IN THE ENVIRONMENT

General

Evaluation of Current Data and Needed Research to Obtain Clearance for Safe, Effective Chemicals for Minor Uses on Agricultural Products. A list of "Edible Crops and Plants Growing in the United States" has been assembled. The Latin binomials have been checked by USDA-ARS-Crop Protection Research Branch and New Crops Research Branch. This list is now in the process of categorization to include all minor crops in categories established by the FDA for pesticide tolerance purposes and by USDA-PRD for label registration purposes. At present there is no available listing of all edible crops grown in the United States and territories or any recognized listing of minor crops. This list will provide a basis for future pesticide tolerance extensions and label registrations. A listing of the food plants of the world would lay the basis for establishing pesticide tolerances on many imported crops not now covered. In addition foreign governments would be provided with a valuable aid for establishing tolerances on indigenous crops. In this way worldwide pesticide tolerances could be coordinated. (E-fg) New Jersey Agr. Exp. Sta. 1-A

International Pesticide Specifications. The Pesticide Chemicals Research Branch, Entomology Research Division, ARS, is working in cooperation with representatives of other countries in development of international specifications for a number of pesticide formulations for the Food and Agriculture Organization. (I) Beltsville, Maryland. 1-A

Transport and Dispersion of Fine Spray Particles. Dispersion studies were continued at the Pioneering Research Laboratory on Fine Particle Physics at Wooster, Ohio, with colloidal particles in water undergoing low-speed flow through a square duct having a steady electric field applied perpendicular to the flow direction and two opposite duct walls. Measurements of the fluid turbulent velocity were made by means of hot-film anemometry. A modified turbulent dispersion theory was developed which gave an adequate prediction of colloid concentrations throughout the duct on the basis of the flow measurements. Theory was also developed to describe the random motion of particles suspended in a turbulent fluid for the case when particle initial velocity cannot be neglected. (I) Wooster, Ohio. 1-A

Distribution of Solid Materials from Aircraft. Equipment has been developed for application of agricultural materials from fixed-wing aircraft. (1) A full scale fluted rotor engine-driven metering device has been constructed for use in a positive-energy system for the distribution of solid materials, (2) a device has been constructed and tested which is capable of generating small uniform liquid particles for use in a study of the behavior of small spray particles in complex flow fields, and (3) aircraft operating productivity has been studied. (E) State College, Mississippi. 1-A

Microbial Dechlorination of DDT. Escherichia coli dechlorinated p, p' DDT to DDE and DDD when grown in Brain Heart Infusion Broth, Nutrient Broth and Trypticose Soy Broth containing 0.8 ppm p, p' DDT and technical DDT. The p, p' peak of DDT was 90 percent dechlorinated in two days. DDT was not dechlorinated by E. coli when grown in skim milk containing DDT. DDT was not dechlorinated during the manufacture or curing of cheddar cheese. (E-fg) Kentucky Agr. Exp. Sta. 1-A

Monitoring and Assay of Phytotoxic Airborne Pesticides and Volatile Pollutants. Daily air samples have been taken from two locations in and near Ames, Iowa, as well as rainfall sampler for pesticide contamination. Both air and water samples indicated the majority of contaminants were present during June and early July with marked drop-off after July 15. (E-fg) Iowa Agr. Exp. Sta. 1-A

Electrostatic Pesticide Application. Prior to the discovery that charged dust clouds were neutralized by a spray of oppositely charged ions coming from tips of cotton leaves, deposition efficiency was 200 ± 50 percent of that of uncharged dusts. With subsequent improvements the deposition efficiency of charged dusts was increased to 300 ± 50 percent of that for uncharged dusts. For an equivalent plant coverage, spray application rates can be reduced to one-half and dust rates reduced to one-third of conventional uncharged applications when the most efficient charged application equipment is used. (E-fg) North Carolina Agr. Exp. Sta. 1-A

The Effect of Fungus Products on Higher Plants, Algae and Viruses. Continued progress is being made in describing the structural formula of Malformin A, a metabolic product of the fungus Aspergillus niger, which produces malformations of bean plants and severe curvatures of corn roots. Cultural filtrates of about 1,000 unidentified Streptomyces were examined for plant growth regulator activity, and numerous active filtrates were detected. Malformin A was identified as the active substance produced by one Streptomyces filtrate. (E-fg) Indiana Agr. Exp. Sta. 1-B

Chlorinated Pesticide Residue Detection. It is difficult to clean up chlorinated pesticide residues in livestock feeds for analysis. Single-step chromatographic procedures proved inadequate for preparing samples for analysis by thin-layered chromatography. A two-step procedure using successive columns of carbon-celite and partially inactivated Florisil proved very effective with all types of feeds encountered. The carbon-celite procedure was modified for preparing samples for both gas and thin-layered chromatography. Using a 1 g sample of feed, residues can be detected at 0.01 p.p.m. (I) Beltsville, Maryland. 1-C

Synthesis of Repellents. Fifty-one compounds were prepared and submitted to the Savannah laboratory for preliminary biological evaluation. A high percentage was more effective than the synergized pyrethrins standard, showing the merits of a guided and selective synthesis program. Preliminary mammalian toxicity tests were conducted with 22 of the more promising compounds. (E) Midwest Research Institute. 1-C

Rapid Extraction and Cleanup for Residue Analyses. The feasibility was demonstrated of using liquid-solid column chromatography as a separation and analytical method for some chlorinated hydrocarbon pesticides. Suitable techniques were developed for blending the sample with the solvent and for separating a clear extract in a single chamber. A new substrate for thin-layer chromatography (TLC) and a scanner for TLC plates were developed. There are indications that a large part of the cleanup can be accomplished by TLC, which is also effective as the separation method. It appears possible to automate the individual steps of cleanup, separation, and detection. Current effort is devoted to that end. (E) Stanford Research Institute. 1-C

Portable Gas Chromatograph. Substantial progress has been made toward developing analytical procedures for a self-sustaining portable laboratory with gas chromatography as the final step for determining pesticide residues in food and feed. Complete processing of a sample is currently accomplished with less than 100 ml. of total solvents. Hydrolysis of sample matrix and the use of high processing temperatures have been avoided to maintain

simplicity and speed. Operating temperature for chromatographic analysis is 180° C., which is below the 200° upper limit that was set as an objective. Chromatographic separation of test pesticides can be accomplished in 10 minutes and processing prior to chromatography may require about 20 minutes. Tests with some residues in wheat, apples, and tomatoes suggest a sensitivity of 0.025 to 0.06 p.p.m. (E) Hewlett-Packard Company. 1-C

Secondary Physiological Effects of Malathion. A study has begun to determine the effect of various concentrations of malathion on oviposition by the Indian-meal moth. At one concentration the peak of oviposition occurred at 9:00 p.m. Pacific Standard Time for both treated and untreated moths. Treated moths laid more eggs the first day than did untreated ones but the viability was low. Treated moths produced fewer eggs and offspring than did untreated moths. When last instar larvae were treated with malathion, swelling of the thorax and abdomen was observed in some and an occasional dead larva was found to have adult as well as larval characteristics. This information was given to an insect physiologist at the Savannah Laboratory for further investigation. (I) Fresno, California. 1-C

Biological Evaluations of Residue Barriers. Laboratory tests have been made on 82 barrier systems and repellent formulations prepared under the contract with the Battelle Memorial Institute. The single-ply concept of barrier and repellent on the same sheet of packaging component appears to be impractical. There are indications that applying barrier coatings over polyethylene reduced their effectiveness. Saran or polyvinyl alcohol coatings over an undercoat of styrene-butadiene were some of the more effective barriers to residue migration. Laboratory tests of residue barriers for use in treated cotton bags indicate that polypropylene film, saran-coated polypropylene, saran-coated kraft paper, and greaseproof paper may be effective barriers against residue migration into packaged commodities. Heat sealing the saran-coated kraft or polypropylene to the cotton appeared to reduce the barrier properties of the saran coating. (I) Savannah, Georgia. 1-C

Evaluation of Repellents. Preliminary evaluation of 63 compounds revealed 17 more repellent than synergized pyrethrins to red flour beetle adults. Eight were rated in Class V, giving 80 to 100 percent repellency. All but 2 of the top 17 compounds came from the Midwest Research Institute synthesis contract. These compounds will be evaluated in other phases of the program as potential treatments for insect-resistant packages or as protectants for stored grains. (I) Savannah, Georgia. 1-C

Stability of Repellent Treatment for Packaging. Very little piperonyl butoxide was lost from a mill roll of kraft paper treated with synergized pyrethrins and aged in storage for 1 year. Periodic chemical analyses were made during

the year. Treated multiwall kraft bags stored in a bundle lost very little piperonyl butoxide but there was a rather rapid movement from the outer to the inner plies of the bags. (I) Savannah, Georgia. 1-C

Search for Safer New Insecticides. Two new compounds were highly synergistic with carbaryl in preliminary tests against confused flour beetle adults and black carpet beetle larvae. Since carbaryl and other carbamates are not generally very effective against these insects, the finding of synergists may open the way for potential development of a new group of safe insecticides for use against stored-product insects. Preliminary evaluation of 65 new compounds against 2 representative stored-product insects revealed 34 promising enough for further testing. In the next elimination 21 were selected for formulation and developmental studies. (I) Savannah, Georgia. 1-C

Insect-Resistant Cotton Bag. The Market Quality Research Division in cooperation with the Southern Utilization Laboratory and industry has developed a promising insect-resistant cotton bag. It effectively protected the contents against insect infestation during 9 months of storage in a heavily-infested test room. Residues in the flour did not exceed those established by Food and Drug for multiwall paper bags with a comparable level of treatment with synergized pyrethrins. Arrangements are proceeding for a large-scale overseas shipping test. (I) Savannah, Georgia. 1-C

Serological Pesticide Residue Detection Method. The first evidence of antibody formation against insecticide derivatives has now been obtained after a number of unsuccessful attempts through several different approaches. The sera from rabbits inoculated with DDA-FBN (dichlorodiphenyl acetic acid - bovine fibrinogen) agglutinated both fibrinogen and DDA-FBN. Similar results were obtained with malathion mono ester - bovine fibrinogen. Research will continue to determine whether a simple, rapid, and accurate test-tube method can be developed for detecting and measuring pesticide residues by the serological approach. (E) General Foods Corporation. 1-C

Insecticidal Drift from Airplane Application. Acinphosmethyl, one-half pound/acre was applied by airplane from altitudes of 8-ft. and 30-ft. as a low-volume spray containing 22.5 percent of the technical compound. Drift and distribution were monitored both chemically and biologically. The deposits of azinphosmethyl extended to a considerably greater distance when applied from the 30-ft. level than when applied from the 8-ft. level. Azinphosmethyl was found in air samples at a distance of 2,000 ft. from the spray area. (I) Beltsville, Maryland. 1-C

Insect-Resistant Bags Tested in Military Channels. Flour in treated multiwall paper bags with improved heat-seal closures was shipped from the mill

by rail and stored at the Naval Supply Center at Norfolk, Virginia. After 24 months 75 percent of the untreated stitch-over-tape bags and 92 percent of the treated bags with wax dip over the stitching were infested. Only 10 percent of the treated bags with heat-sealed tape-over-stitching or pasted-open-mouth closures were infested, and this was at a very low level. Nearly all the heat-sealed bags remained free of insects during 6 to 9 months in heavily infested simulated warehouse storage at the Savannah laboratory. Seventy percent of the treated bags with wax-dipped closures were infested within 3 months under the same storage conditions. Piperonyl butoxide residues in flour from treated bags never exceeded the established tolerance of 10 p.p.m. (I) Savannah, Georgia.

1-C

Treating Rayon Thread with Pyrethrins Plus Piperonyl Butoxide Protected It Completely Against Feeding Damage by cigarette beetle larvae and produced high mortality in the test insects. Dusting untreated thread with degermed cornmeal or wheat flour made the fibers more attractive to the insects and increased the amount of damage. The cigarette beetle causes serious damage to rayon bags used for animal feed and similar products. (I) Savannah, Georgia.

1-C

Another Dichlorvos Use Explored. Daily applications of dichlorvos aerosol dispensed by an automatic system at a cannery in a warehouse where empty cans are stored prior to filling have given protection for 2 months against insects getting into the empty cans. After 2 months of treatment, residues of 7.5 micrograms per can were found inside unbroken containers of cans. Potential use of this method will be dependent upon the nature of tolerances established for dichlorvos in foods as a result of a petition now pending with the Food and Drug Administration. (I) Savannah, Georgia.

1-C

Developing Residue Barriers for Food Packages. Several series of barrier systems were prepared for testing. These included saran, polyvinyl chloride, polyvinyl acetate, polyvinyl alcohol, polycarbonate, and acrylonitrile applied from solvent and emulsion systems to undercoats of styrene-butadiene or polyethylene. (E) Battelle Memorial Institute.

1-C

Candidate Fumigants Evaluated. Of 29 new compounds, 3 were more effective than methyl bromide as space fumigants against confused flour beetle and cigarette beetle adults and black carpet beetle larvae. None was effective in penetrating grain as a fumigant. Tetrachlorocyclopropene was indicated to be more effective against confused flour beetle at 60° F. than at 80°. Such interesting and unusual performance needs further verification. Ethide (1,1-dichloro-1-nitroethane), previously found effective as a space fumigant, was shown to be more effective than methyl bromide as a fumigant for wheat at 80° F. As with most other fumigants, the effectiveness decreased at lower temperatures. (I) Savannah, Georgia.

1-C

Screening New Materials for Insect Control. Screening tests were made of new compounds from government and industrial sources as potential insect control agents at 29 laboratories of the Entomology Research Division in the United States and Mexico. During F. Y. 1967, 302 compounds were tested for insecticidal or acaricidal activity, 154 for insect attractancy, and 464 for repellency. In addition, 114 compounds were further evaluated in the field. A number of these showed considerable activity as insecticides. Mammalian toxicity data indicate a good margin of safety for some of these materials. (I) Beltsville, Maryland; and 28 other locations. 1-C

Photodecomposition of Pesticides. Pesticides generally are applied in the field, where they become exposed to the action of sunlight (or, most important, its ultraviolet component), air, and moisture. Our previous investigations have shown that many economically-important pesticides suffer photodecomposition. The photolysis of a number of important pesticides, each typical of a broad class, has been investigated in detail with UV light in the laboratory and in sunlight. In each instance of irradiation in solution, the solvent acted as a chemical reactant to substitute hydroxyl (in the case of water) or hydrogen (in the case of organic solvents) for reactive atoms such as halogen. (E-fg) California Agr. Exp. Sta. 1-C

New Pyrethrum Synergist, Tropital. Tropital (bis-[2-(2-butoxyethoxy)=ethyl] acetal of piperonal) was tested as a synergist for pyrethrins in aerosols and sprays. It compared well with the widely used synergist piperonyl butoxide. Tropical has been included as a third synergist (in addition to piperonyl butoxide and sulfoxide) in a proposed amendment to the Federal aerosol specification 0-I-507. (I) Beltsville, Maryland. 1-C

Soil Insecticides for White-Fringed Beetle Control. Twenty-nine compounds were tested as soil insecticides for white-fringed beetle larvae and 8 gave results comparable to DDT. They are isobenzan, nonachlor, mirex, Dursban, Compound 4072, Stauffer N-2790, and experimental compounds ENT-27,184, and ENT-27,448. (I) Gulfport, Mississippi. 1-C

Substitutes for Persistent Insecticides to Control Japanese Beetle Grubs. Soil surface applications of diazinon, during October 1966 using dosages as low as 8 lb/acre, killed all overwintering larvae. Untreated plots averaged more than 4 larvae per ft². Larvae were within 2 inches of the surface at time of application. (I) Moorestown, New Jersey. 1-C

Influence of Repellency on the Efficacy of Insecticides for Cockroach Control. The relative insecticidal efficiency of currently used insecticides in liquid and dust form was compared when the cockroaches have the "choice" of entering the insecticide deposits or staying out of them. Repellency was found to be the principal factor determining the effectiveness of blatticides. German

cockroaches have the ability to "learn" to avoid insecticides. Relative toxicity was of no importance, provided that the material had at least some perceptible toxicity. The least toxic material worked with, boric acid powder, proved to be the most satisfactory in eliminating a roach population in the choice boxes. In extensive field experiments in apartments, houses, restaurants, hotels and hospitals, it also proved to have the best long-term effectiveness. (E-fg) California Agr. Exp. Sta. 1-C

Electrostatic Spraying with Aircraft. Previous work has indicated that electrostatically charged spray released from aircraft, generates a large residual charge on the airframe. The effects of this phenomena were investigated theoretically and proven experimentally. Results of the exploration led to a study of three techniques which may be used when sprays are to be electrically charged: Technique of polarity reversal, dual power supply technique, and gaseous ion emission. (I) Beltsville, Maryland. 1-C

Volatilization of Lindane and Dieldrin. The volatilization of lindane and dieldrin from a glass surface (contained in an all-glass system) was measured at 27° C. and 30-40 percent relative humidity at a flow rate of 800 ml of air/min. Over 72 hour period, the dieldrin and lindane had volatilized in the amount of 10 percent and 50 percent, respectively. Under the same conditions, the dissipation rate of lindane from the surface of bean leaves was essentially linear; with respect to time approximately 50 percent of the compound had dissipated at the end of 72 hours. (E-fg) Colorado Agr. Exp. Sta. 1-C

Analytical Methods for Insecticide Residues in Milk. Gas chromatographic procedures using a flame photometric detector have been developed for analysis of residues of several organophosphorus and carbamate insecticides and their metabolites in milk or animal tissues. These include methods for coumaphos and its oxygen analog, Shell SD-8447 and its hydrolysis product, Stauffer R-3828 and its oxygen analog, Mobil MC-A-600, and Niagara NIA-10242 and its phenolic degradation product. (I) Tifton, Georgia, and Beltsville, Maryland. 1-C

Analytical Methods for Insecticides in Plants. Gas chromatographic procedures have been developed for residues of malathion and its oxygen analog malaoxon, diazinon and its oxygen analog diazoxon, Mobil MC-A-600, Niagara NIA-10242 and its phenolic degradation product, Union Carbide UC-21149 and its sulfoxide and sulfone derivatives, and carbaryl in various crops. (I) Beltsville, Maryland; Tifton, Georgia; and Yakima, Washington. 1-C

Non-Toxic Oils Enhance Herbicidal Activity. Non-toxic oils in combination with the herbicide, EPTC, enhanced the preemergence activity of EPTC against yellow nutsedge in the greenhouse. Paraffinic oils were superior to naphthenic oils and oil No. 11N (12.8 percent aromatics) was superior to 6 other oils. The enhanced activity of EPTC appears to be a result of reduced volatility of the EPTC plus oil in comparison with EPTC alone. Field studies with EPTC-oil combinations were inconclusive due to the variable nutsedge stand. --Several oils were synergistic when applied with atrazine for post-emergence control of yellow nutsedge. (E-fg) Maryland Agr. Exp. Sta.

1-D

Technique Devised to Determine Drift of Sprayed Aquatic Herbicides. A technique was devised to use a non-toxic, water soluble fluorescence dye to determine drift of sprayed herbicides applied on aquatic weeds growing in the water. The use of this dye also permits determination of dispersion of herbicides applied on submersed weeds. Growths of alligatorweed in flowing water have been satisfactorily controlled for 2 years by 2 applications yearly (one in late June and another in mid-August) of a 50-50 mixture of 2,4-D BEE plus silvex BEE at rate of 4 lbs. a.e./A plus on addition of 2 lbs/A of emulsifier in the spray solution. Residue studies indicate that diquat may be a much safer herbicide to use on aquatic areas which will require retreatments. (E-fg) Alabama Agr. Exp. Sta.

1-D

Granular Formulations of Herbicides were as Effective and in Some Cases More So Than Sprays. Granular formulations of herbicides tested were as effective and in most cases more effective on weed control than the sprayable formulations. The planting of row crops in weeds on early prepared seed-beds and applying a post-emergence herbicide gave excellent weed control for a long time with no injury to crop plants. (E-fg) Mississippi Agr. Exp. Sta.

1-D

DMSO Enhances Response of Plants to Herbicides. Dimethylsulfoxide enhance response of plants growing in a controlled environment to the applied herbicide, in most cases. The phytotoxic effect of 2,4-D was evidenced whether it was applied alone or in combination with other herbicides. Rate of response to 2,4-D was accelerated by either atrazine or prometone, but atrazine was more effective than prometone. An interaction was also demonstrated between atrazine and dicamba but this combination was only partially as effective as the atrazine-2,4-D combination. (E-fg) Ohio Agr. Exp. Sta.

1-D

Combination of Cultural and Chemical Practices was Effective in Bindweed Control. In 3 years almost complete eradication was obtained with several practical combinations. One fall application of several sterilant chemicals

and normal cultural practices has given almost complete bindweed control with no crop injury the second year. (E-fg) South Dakota Agr. Exp. Sta.
1-D

Application of Herbicides in Foam State. Crops Research Division scientists are investigating the application of herbicides in the foam state. Foam-state applicators may offer a new effective way of placing herbicides into hard-to-reach places, and a means of confining the pesticide to the target area. Situations in which the new technique might be valuable include row crops where the row profile is rough, on ditchbanks, and problems of controlling emergent weeds in canals. Foam-state application provides a high-volume:low-weight ratio, and this may facilitate better control of weeds with lower rates of active pesticide. (I) Stoneville, Mississippi.
1-D

Control of Ditchbank Weeds with Herbicides. In Montana, picloram at 0.5, 1, and 2 lb/A reduced the Canada thistle stand 68 to 100 percent, whether alone or combined with 2, 4-D at 2 or 4 lb/A. Dicamba at 5- and 8-lb/A rates reduced the stand 62 and 83 percent, respectively. Dalapon and TCA each applied at rates of 20, 40, and 80 lb/A in December 1966 eliminated 90 to 96 percent of the reed canarygrass along the bank of a Montana irrigation canal as observed in July 1967. The two herbicides were equally effective and there was no advantage for the higher rates. Mixtures of amitrole-T with dalapon, pyriclor, or TCA gave better control of canarygrass than did higher rates of each herbicide alone. MSMA was not effective on canarygrass alone or in combination with amitrole. In Washington, single applications of picloram as spray or beads at rates of 1, 2, and 4 lb/A to mowed stubble or mature growth reduced the stand of Russian knapweed 99 to 100 percent. In the same area, foliar spray applications of dicamba at 4 lb/A in the spring plus retreatment in the fall eliminated the knapweed. (I) Bozeman, Montana; and Prosser, Washington.
1-D

The Control of Water Lettuce and Water Hyacinth. Water lettuce was controlled with diquat at 1.0 to 1.5 lb/A. Water lettuce is the preferred host plant for *Mansonia* mosquitoes, which have been incriminated as a vector of encephalemyelitis and rural filariasis. A large operational treatment of diquat at 1.5 lb/A resulted in excellent control of 300 acres of water lettuce. The elimination of water lettuce in this area resulted in control of *Mansonia*. Diquat has also proven to be an effective control of water hyacinth in areas where 2, 4-D cannot be used. Recent studies indicate that ametryne is also effective on water hyacinth. (I) Fort Lauderdale, Florida.
1-D

Control of Florida elodea with Herbicides. In 1962 research scientists began to observe the rapid ecological shift in submersed aquatic vegetation in Florida. Florida elodea (*Hydrilla verticillata*) spread rapidly into the canals,

lakes, and streams until in 1966 it was reported as the number one aquatic weed problem in the State. Control methods used for control of other species of aquatic weeds were not effective on this plant. ARS scientists found that the amino salt of endothall (mono-N, N, dimethylalkylamine salt of 7-oxi-bicycle[2, 2, 1]= heptans-2, 3-dicarboxylic acid) had outstanding herbicidal activity on most species of submersed aquatic weeds including Florida elodea. Time concentration studies in the laboratory showed that it required a very short herbicidal contact time. It should be emphasized that the amino salt of endothall is not the final answer to the Florida elodea problem. It is only a herbicidal practice that is being used until a better method of control is developed. (I) Fort Lauderdale, Florida. 1-D

Selected Application of Herbicides to Weeds Taller than Crops. Weeds such as sesbania, cocklebur, and shattercane often grow taller than the crop which they infest. Soon, they may face a new weapon developed from weed science--the recovery sprayer. This device directs a stream of herbicidal spray a few inches above the crop into a large funnel-like trap which returns the spray to the tank from which it came. Tall weeds intercept the spray and are killed, but if the weeds are scattered, most of the spray is recovered and used again. Since there is little or no contact between the crop and the herbicide, the crop escapes injury. (I) Stoneville, Mississippi. 1-D

Submersed Aquatic Weed Control in Irrigation Systems with Acrolein. ARS researchers at Prosser, Washington, in cooperation with the Bureau of Reclamation, experimentally treated the East Low Canal, Columbia Basin Project, six times per season in 1964 and 1965 with acrolein at 0.1 p. p. m. w. for 48 hours. Waterflow in the canal averaged 2000 cfa at point of introduction. The treatments effectively suppressed submerged aquatic weeds throughout the season. Suppression in the main canal was excellent for 10 to 20 miles downstream, and sufficient from 20 to 50 miles to permit the necessary delivery of water. Suppression of pondweed top growth was good to fair in most of the branch laterals also. In the main canal, the treatments reduced the stands of sago pondweed and inhibited axillary tuber and seed production. Subterranean tuber production also was reduced markedly in the first 5 miles. Subsequently, several large irrigation systems in this region are now treated effectively and economically with acrolein on an operational basis. (I) Prosser, Washington. 1-D

Animals

An Insecticide Fed to Cattle Produced No Residues in the Milk. Coumaphos up to 48 ppm in cattle feed appeared in the feces but neither coumaphos or its oxygen analog appeared in the milk samples. (I) Tifton, Georgia. 21-C

Significance of Hair Loss. A study to determine the significance of hair loss as a factor contributing to insecticide loss has yielded data indicating the seasonal cyclic patterns of hair growth and loss on a cow for a complete year. Hair loss during the early summer reached a peak of 0.89 percent per day of the total quantity of hair on the cow. Such a loss could account for an equal percentage loss of insecticide from cattle during this season. (I) Kerrville, Texas. 21-C

Efficient Mosquito Larvicides. Dursban and Abate have been found to be the two most efficient larvicides tested for Aedes taeniorhynchus mosquitoes. They are considerably more effective than fenthion, DDT, malathion, or naled and 2 to 3 times better than parathion, the most previously effective compound. Abate is a relatively nonhazardous material that is almost specific for mosquito larvae. The toxicity of Dursban may be similar. (I) Gainesville, Florida. 21-C

Reduced Amounts of Insecticide Control Horn Flies with New Sprayer. A new automatic sprayer controlled horn flies on cattle with only 1 milliliter of spray per animal applied twice daily. Insecticides tested and found effective included carbaryl (1 percent), Ciodrin (0.5 percent), Compound 4072 (0.25 percent or 0.1 percent), coumaphos (0.25 percent), malathion (1 percent), and methoxychlor (1 percent). Malathion applied at 2 percent and 5 percent resulted in no residues in milk or dairy cows so treated. (Sensitivity of analytical method was 0.001 ppm). (I) Kerrville, Texas. 21-C

USDA Research Pays Off for Armed Forces. The Air Force requested assistance on a problem of carpet beetle damage to rubberized animal hair padding around electronic instruments in packing cases. The protection against impact was lost when insects consumed the hair. Equipment and a procedure for applying a protective treatment to the hair were developed. These are now incorporated into a proposed Federal Specification. The special research cost about \$2,200. The Air Force estimates use of the results will save them \$300,000 a year for 3 years just in preventing loss of padding material and avoiding repacking and extra handling. This is only a fraction of the saving because there is no estimate yet on the cost of damage to instruments, repairs, rechecking, and recalibration. (I) Savannah, Georgia. 21-C

Biology, Ecology, and Control of Livestock Pests. Burlap dusters, containing 3 percent Ciodrin, 5 percent coumaphos or 5 percent Tiguvon; pour-on applications of Tiguvon and trichlorfon and coumaphos, and an oil application of Tiguvon to burlap backrubbers was used in lice control studies. All tests, except the pour-on gave 100 percent control of the biting louse Bovicula bovis by the end of 1 week. Pour-on applications required a longer time before effective control was achieved. Hand applications of 5 percent Tiguvon or 2 percent Ciodrin dust to the back and upper side of swine was effective against the hog louse, Haematopinus suis, for 1 week. The sheep ked, Melophagus ovinus, was also controlled by use of self duster containing 5 percent Tiguvon. Enough dust accumulated in the sheep wool after a short period of use to prevent further reinfestation from untreated sheep. (E-fg) Kentucky Agr. Exp. Sta. 21-C

Automatic Sprayers. The results of laboratory tests, field studies, and insecticide residue in milk studies indicate that the ULV techniques has considerable potential as a means of reducing the hazards associated with chemical control of livestock insects. In laboratory tests it was found that the application of Ciodrin^R, Malathion, Sevin^R, or GC-4072 at a rate of 1 ml twice daily in concentrations of 0.5 percent to 1 percent is capable of protecting cattle from the horn fly. A study was conducted to determine the potential of the ULV techniques in reducing insecticide residues in milk. No Malathion residue was detected in milk samples taken from 2 dairy cows sprayed with 1 ml twice daily for 21 consecutive days with 2 percent and 5 percent Malathion in xylene. Ronnel applied in like manner at concentrations of 5 percent and 10 percent resulted in residue in the milk beginning with the first day's spraying. There was a continuous build-up of ronnel in the milk through the 28 treatment days. (I) Kerrville, Texas. 21-C

Value of Treating Cattle for Worms Before Pasturing. Stocker beef cattle should be treated for nematode parasites before they are put on a clean pasture. Steers treated with thiabendazole at the beginning of the grazing period maintained a lower parasite population, greater weight gains, and had better carcass and slaughter grades. The daily low-level feeding of thiabendazole, given as a feed additive at a level of either 1, 2, or 4 mg/kg body weight, did not have any apparent effect on the parasite population in 40 calves, as seen from fecal egg counts made at regular intervals during the 90-day period, and necropsy of four calves from each of the groups. The treatment did not affect the weight gains of the calves. (I) Experiment, Georgia. 21-E

New Chemotherapy for Helminthic Infections in Ruminants. Tetramisole (dl 2, 3, 5, 6-tetrahydro-6-phenylimadizo (2, 1-b) thiazol hydrochloride), a new anthelmintic for livestock, was effective against adult stages of the

large stomach worm, Haemonchus contortus, and the stomach and intestinal hairworms, Trichostrongylus axei and T. colubriformis, respectively, of sheep and goats. These roundworms interfere with the normal metabolism of the host, resulting in morbidity and sometimes death. Preliminary data indicate that tetramisole compares favorably with thiabendazole and purified, micronized phenothiazine as effective treatments against these three major parasitic pathogens of ruminants. (I) Beltsville, Maryland. 21-E

Acaricides Effective Against Scabies Mites on Sheep and Cattle. Three organophosphorus acaricides (2 phosphorodithioate and 1 dimethyl phosphate compound) are effective for the eradication of the scabies mite, Psoroptes ovis, on sheep and cattle. Large-scale pen tests employing single applications of the drugs in dipping vats were completely successful. One of the compounds is already registered for use as an insecticide on dairy cattle. The drugs may find wide application for use on dairy cattle and goats afflicted with scabies and mange, since no satisfactory agent currently is available. (I) Albuquerque, New Mexico. 21-E

Efficacy of Co-Ral as Anthelmintic in Cattle. The efficacy of Co-Ral was tested as an anthelmintic in cattle. Critical tests indicated that, when administered as a feed additive at a dose level of 1.25 mg/kg of body weight for 6 consecutive days, Co-Ral was highly effective against Haemonchus placei, Cooperia punctata and C. oncophora, and less effective against Ostertagi ostertagi, Trichostrongylus axei and T. colubriformis. The efficacy of Co-Ral crumbles given as a feed additive on a low level basis at the rate of 2 mg/kg of body weight for 6 days was 97 to 100 percent effective against H. placei, C. punctata, C. oncophora, and Trichostrongylus spp., 86 percent effective against O. ostertagi, and 73 percent against Oesophagostomum spp. (I) Experiment, Georgia. 21-E

Dimetridazole Shows Promise as Systemic Treatment for Bovine Venereal Trichomoniasis. Infected bulls have been cured when dimetridazole was given orally or by intravenous injection. The results of current research indicate that infected cows also respond favorably to 50 mg/kg administered by capsule daily for 5 successive days, or to a single intravenous injection at the same dose level. Thus, it is probable that treatment can be administered on a herd basis, thereby eliminating the possibility of within-herd reinfection and permitting the return of all cattle to production much sooner. (I) Beltsville, Maryland. 22-E

Control of the Spinose Ear Tick in Cattle. Aqueous emulsions containing cioldrin, instilled in the external auditory canal of cattle, were highly effective in destroying Otobius megnini, the spinose ear tick. From a residual standpoint, the drug has a considerable advantage over lindane, and is

slightly superior to coumaphos, the current remedies of choice. It was also observed that, while low-pressure, whole-cow sprays failed to penetrate into the ear canal, plunge dipping in ciodrin destroyed all O. megnini larvae and nymphs within 48 hours. (I) Albuquerque, New Mexico. 22-E

Pesticide Removal from Milk. Pesticides (Lindane, DDT, Methoxychlor, Parathion) were added directly to whole milk or butter oil. After thorough mixing of the mixture, an aliquot was removed to serve as a control. The remaining portion was then subjected to specific treatments (distillation, fractionation by cooling, electrohydraulic shock, adsorption). Following the treatments, the pesticides were extracted. Results were as follows: (a) Fractional precipitation of glycerides in butter oil showed the pesticide went with the liquid (or more unsaturated fraction). The solid-liquid separations were DDT 21-79, Lindane 52-48. (b) When samples of milk were passed through a column of Florisil-charcoal (2:1 w/w), 58 percent of the Lindane, all of Endrin and none of DDT was removed. With butter oil, none of the pesticides were removed. (c) When pesticides were added to petroleum ether and filtered through a Florisil-charcoal column, all residues were removed. This suggests that solvents used for pesticide work might be purified using this technique. (E-fg) North Carolina Agr. Exp. Sta. 23-A

Removing Pesticides from Milk. Telodrin and methoxychlor were fed to lactating dairy cows or added directly to milk. The milk was processed into dried whole milk and evaporated milk. Heat treatments for processing evaporated milk destroyed between 40-50 percent of telodrin and 20 percent of methoxychlor residues in the raw milk. Drying processes destroyed 10-20 percent of telodrin and essentially none of the methoxychlor. A procedure for sample preparation originally developed for five chlorinated insecticides was applied to sample clean-up for analysis of eleven additional insecticides. This increases the potential use of this simple sample preparation procedure. (E-fg) Purdue Agr. Exp. Sta. 23-C

Pasture Control of Cattle Lungworms. Efforts are being made to reduce exposure of calves to internal parasites through treatment of grazing pastures with various larvicides. Moderate success was obtained in controlling lungworm (Dicyocaulus viviparous) infection in calves by application of calcium cyanamide to pastures. A chemical feed additive (Coumaphos) was not as effective as a lungworm larvicide. (E-fg) Florida Agr. Exp. Sta. 23-E

Antioxidant in Feeds Found to Have Anthelmintic Action. An antioxidant used in commercial animal feeds (Ethoxyquin) was found to inhibit the development of larvae of internal parasites in cattle. Increasingly fewer larvae were recovered from calves as the concentration of the antioxidant was increased. Concentrations up to 100 times that used in feeds were effective in their anthelmintic action. (E-fg) Georgia Agr. Exp. Sta. 23-E

Lincomycin Effective Against Certain Stages of Bovine Coccidia. Following the discovery that Lincomycin hydrochloride suppresses bovine coccidia development, further studies were conducted to determine the specific action of the drug. These studies have established that lincomycin exerts specific action against coccidial schizonts only at a specific time in their development. Destruction of these parasitic stages was found to occur through the action of host leucocytes which are apparently stimulated into action against the parasite by the chemical. (E-fg) Wisconsin Agr. Exp. Sta. 23-E

Removal of Pesticides From Laying Hens. Methods to accelerate removal of pesticide residues from laying hens were further developed. A commercially feasible method consisting of severe diet restriction to deplete body fat reserves followed by a full feed with a high energy ration resulted in reducing levels in egg yolk from about 10 ppm to less than 0.5 ppm in 16 weeks. The level of fat and protein in the diet during restricted feeding and full feeding affected the extent of depletion. These findings give a poultryman an alternative to total loss of the flock if they become contaminated with a chlorinated hydrocarbon pesticide. (E-fg) Purdue Agr. Exp. Sta. 24-A

Effect of Cooking on Pesticides. DDT and lindane in the tissues of chickens were reduced considerably when the birds were cooked by baking or frying. DDT, DDE and Kelthane were present in the raw and cooked carcasses, but DDD was found only in the cooked meat. A relationship between the two pesticides in which lindane enhanced the retention of DDT in the tissues appeared possible, but requires further confirmation. Further work on the effects of temperature on DDT retention in which tissues were heated for 30, 60 and 90 minutes at 350° F. has indicated a decrease amount of DDT and an increased amount of DDD with heating. (E-fg) Virginia Agr. Exp. Sta. 24-C

Sorption of Quaternary Ammonium Compounds by Wool. Practical studies with a quaternary ammonium compound showed that this material could be applied in a home type washer to provide an effective mothproofing treatment. Application in a commercial type textile padder was not so effective, probably because there was mostly surface deposition rather than thorough impregnation of the fabric. Desorption studies conducted with radioactive forms of four quaternary ammonium compounds, conducted under selected laundering and drycleaning conditions, showed that all four were removed more readily by laundering with soap and detergents than by drycleaning. (E) Harris Research Laboratories. 26-C

Safer Mothproofing Treatments Sought for Wool. Of the 38 compounds given preliminary evaluation as mothproofers, 5 were found promising because of performance and low mammalian toxicity. Their oral LD₅₀ for rats ranges

between 1,000 and 4,640 mg. per kg. Studies with 23 compounds representing quaternary ammoniums with short or intermediate length alkyl chains, dimethyl benzyl lanolinamido ammonium chlorides, a pyridinium chloride, and several alkylamines, showed that a quaternary ammonium compound with eight-carbon alkyl chains was highly effective against both carpet beetles and clothes moths at deposits on wool of 12 to 30 times less than for other quaternary ammonium compounds previously tested. (I) Savannah, Georgia.

26-C

Treatment Found Effective Against Immature Liver Flukes. Although a number of compounds are effective against mature flukes none have shown much value against immature stages of the parasites. Trials completed with an experimental compound, Bayer 9015, were 100 percent effective against immature stages of Fasciola hepatica in sheep. At effective levels, the drug did not cause any evidence of toxicity to treated animals. This is the first finding of a compound effective against immature liver flukes.

(E-fg) Oregon Agr. Exp. Sta.

26-E

Evidence of Thiabendazole Resistance in Horse Strongyles. The first evidence of strongyle resistance to thiabendazole has been found in horses given monthly drenches of the compound over a period of three years. Phenothiazine and piperazine mixtures have continued to be effective in control horses. If further work confirms these findings it appears that the usefulness of thiabendazole against strongyles may be limited. (E-fg) Kentucky Agr. Exp. Sta.

27-F

Treatment Against Threadworm. Methyridine is an effective treatment against the intestinal threadworm, Capillaria obsignata, in pigeons.

(I) Beltsville, Maryland.

28-E

Anthelmintic Against the Cropworm. Haloxon, an organophosphorus compound, had significant anthelmintic action against the cropworm, Capillaria contorta, in quail. (I) Beltsville, Maryland.

28-E

Field Crops

Machine Design and Operating Characteristics for Incorporating Chemicals in Soil. A 14 inch diameter rotor with four parallel blades was designed to mix granular chemicals in field soils. Operating characteristics and power requirements were determined to obtain uniformity of incorporation. (E-fg) Illinois Agr. Exp. Sta.

31-A

Resistance to Malathion. Nine strains of the almond moth from warehouses in Georgia and Florida showed 8- to 13-fold resistance to malathion over the normal laboratory strain. This is about a 3-fold general increase over levels of resistance found during the 1965-66 storage season. Several of the strains were from peanut warehouses where malathion had been used for 7 storage seasons. Several new compounds were tested against resistant strains. One with very low mammalian toxicity was highly effective against resistant as well as normal strains. (I) Savannah, Georgia. 31-C

Good Rail Car Fumigation. Further tests with phosphine fumigation of processed cereal products in rail cars show that 165 aluminum phosphide pellets per 1,000 cu. ft. gives highly effective results in standing or rolling cars when proper procedures are followed. Two new techniques for applying the pellets were tested and found effective. In one method the pellets are crushed and in the other they are ground and the dust is blown into the cars. Both methods produce gas almost instantly instead of after 3 hours as with whole pellets. Attaining a lethal concentration of gas so promptly should improve the efficiency of the fumigation operation. (I) Manhattan, Kansas. 31-C

Chemical Weed Control in Corn. Equipment studies show that dalapon can be applied to corn if nozzles are arranged to prevent the spray from contacting the corn leaves. Linuron (2 lb/A) more effective with a directed sprayer when the corn was 12 inches high. Dinitro (3 lb/A) can be used as a post-emergence herbicide in 6-inch high soybeans if spray is directed to the lower stems of the plant. Preemergence herbicides applied in 8-inch bands are as effective as those in 16-inch bands. In low volume preemergence applications (.5 to 5 gpa) of herbicides, trifluralin is more effective than amiben, and an air atomizing nozzle is better than a fan nozzle. (I) Columbia, Missouri. 31-D

Weed Control With Liquid and Granular Herbicides Compared. Several herbicides were applied to field corn before and after planting using liquid and granular formulations incorporated into the soil with various tools. Sprays were as effective as granules. Chemical applications gave better weed control and higher yields than cultivated checks. Soil incorporation did not materially improve weed control with any chemicals, however, the cultivating action of the incorporating tools without chemicals did improve weed control. Similar tests with soybeans showed liquids as effective as granules, and weed control obtained with mechanical cultivations as good as that obtained with most chemicals. (I) Ames, Iowa. 31-D

Oxathiins for Disease Control Give Dramatic Results. An oxathiin chemical has been further evaluated as a seed treatment for the protection of small

grains against smut diseases. In Texas, this chemical known as Vitavax (2, 3-dihydro-5-carboxanilido-6-methyl-1, 4-oxathiin) reduced loose smut infection in wheat from 14 percent in the check to 1 head among 5,000; at Beltsville, Maryland, infection was reduced from 18 to 0 percent in tests made with barley. This is the most sensational control of loose smut that has ever been discovered. The chemical also gives good control of seed-borne stinking smut of wheat. As a further test of its value, permission has been granted to the company which produces it to distribute 5,000 pounds for treating barley seeds and 1,500 pounds for treating wheat seeds in especially selected seed production programs. (I) College Station, Texas, and Beltsville, Maryland.

32-B

Pyrethrins Stimulate Weevil Reproduction. Studies on the effect of sub-lethal dosages of synergized pyrethrins on the rice weevil revealed that certain conditions of exposure increased rather than depressed the production of progeny. This is the first recorded evidence of such an effect. (I) Manhattan, Kansas.

32-C

Improved Grain Fumigation. Serious distributional deficiencies were found when wheat, corn, or grain sorghum at 60° F. or less were fumigated by gravity penetration in 9,000- or 12,000-bu. metal bins with an 80:20 mixture of carbon tetrachloride and carbon disulfide or a 75:25 mixture of ethylene dichloride and carbon tetrachloride. There was poor insect kill and differential sorption created a fire hazard with the 80:20 mixture. When the closed-recirculation method was used there was good gas distribution and excellent insect kill with dosages as much as 1 gal. per 1,000 bu. less than used for gravity fumigation. (I) Manhattan, Kansas.

32-C

Diseases of Spring, Winter and Durum Wheats and Their Control. "Winter killing" of Scout winter wheat was reduced by seed treatment with the chemical Vitavax. Treated plots showed 20 percent mortality compared with 58 percent mortality in untreated plots; chloropicrin-fumigated plots showed a 32 percent kill. Laboratory and greenhouse tests indicated that Vitavax seed treatment does not provide protection against root and crown rot caused by Gibberella zeae. Greenhouse tests with the chemical Plantvax, indicated stem rust control for 30 days following seed treatment. Foliage deposits of Plantvax did not inhibit uredospore germination nor appressorium formation, but pustule development was prevented. This systemic chemical may be changed to a fungicide within the plant or alter host resistance. (E-fg) South Dakota Agr. Exp. Sta.

321-B

Phosphine Fumigation Tests. Phosphine was found effective as a space fumigant in a test conducted in a pilot flour mill. The grinder-blower method of dispensing aluminum phosphide pellets was used. Another test showed that

aluminum phosphide pellets could not be used successfully for the spot fumigation of unsealed flour mill machinery and equipment. (I) Manhattan, Kansas. 321-C

Candidate Wheat Protectant. Bay 77488 was more effective at 5 p.p.m. on wheat than was malathion at 8 p.p.m. against rice weevils, cigarette beetles, and confused flour beetles in small-jar tests after aging 6 months. These insects did not infest the wheat treated with Bay 77488 but some of each species survived and reproduced in the malathion-treated wheat. The Bay compound is of particular interest because of its extremely low toxicity to warm-blooded animals: (I) Savannah, Georgia. 321-C

Seed Treatments Control the Cereal Leaf Beetle. Excellent control of the cereal leaf beetle on spring seeded oats was obtained by the use of a seed treatment of Bay 39007 at 1, 2, 4, and 8 ounces per 100 pounds of seed. Seed treatment with Niagara NIA-10242 and Union Carbide UC-21149 also gave good control. (E) East Lansing, Michigan. 323-C

Equipment for Corn Insects. High-clearance spray equipment was used to apply insecticides for control of adult corn rootworm. High initial kills were obtained. Reinfestation apparently nullified this effect. Diazinon, carbaryl, and methyl parathion gave the highest initial adult kill. Single and repeated applications made in timing studies between August 15 and 22 did not produce significantly different results. Sprays applied to corn for flea beetle control gave significant reductions of infestation. Methyl parathion gave the greatest initial and residual reduction in beetle population but increases in corn yield were not significant. (I) Wooster, Ohio. 326-C

Single Application Controls Two Insects. Granular insecticides at cultivation time resulted in good control of both corn rootworms and corn borers. Soil incorporation improved the rootworm control, but the kinds of tools used for incorporation or the amount of soil worked had little effect on control. Granules applied directly over the corn plant (recommended for borer control) were as effective for rootworm control as basal applications. Granular and liquid application equipment was modified to fit both 30-inch and 20-inch row widths. (I) Ames, Iowa. 326-C

New Method for Applying Malathion to Grain. Tests were conducted to study three factors that were believed might influence the deposition and distribution of malathion on bulk shelled corn when applied by the forced ventilation of aerosols. It was found that grain temperature was not as important a factor as aerosol particle size and airflow rate. Complete mortality of test insects was obtained at depths of 14 feet of grain when aerosol particles of 0.4 micron mass median diameter were moved through the grain with an airflow rate of 0.3 cubic foot per minute. (I) Manhattan, Kansas. 326-C

New Herbicide for Selective Control of Witchweed in Corn. Witchweed (*Striga lutea* Lour.) is a parasitic plant infesting corn and other grass crops. Currently, the infestation in the United States is restricted to approximately 315,000 acres of land in North Carolina and South Carolina. The herbicide 2,4-D (2,4-dichlorophenoxyacetic acid) is our most widely used herbicide in a program designed to eradicate witchweed. Although 2,4-D is very useful, other effective herbicides are needed if the eradication program is to be carried to completion in the most efficient manner. We have been unable to use several effective herbicides, however, because of injury to crops succeeding corn in rotations. In three years of field experimentation, a new herbicide, pyriclor (2,3-5-trichloro-4-pyridinol) now appears effective for selective control of witchweed in corn at rates which several succeeding crops will tolerate. (I) Whiteville, North Carolina. 326-D

Chemotherapy Controls Disease Inside Plant. Flag smut (*Urocystis agropyri*) was inhibited and apparently eradicated in plants of Merion Kentucky bluegrass. All new growth remained disease free for 15 months when 20 to 40 pounds per acre of a systemic fungicide, 2,3-Dihydro-5-carboxanilido-6-methyl-1,4-oxathiin-4,4-dioxide (DCMOD) was applied to soil. The tests were conducted in a greenhouse on plants in pots. Leaf tip scorching occurred within 1 week after soil was treated with DCMOD. The injury gradually disappeared and was confined to distal portions of older leaves. Plant growth was initially retarded but later increased significantly with control of the pathogen. (I) Corvallis, Oregon. 331-B

Fungicides Control Head Smut of Pearl Millet. *Tolyposporium* kernel smut of pearl millet is not readily controlled by seed treatments in areas where the smut has become established. Because the primary inoculum overwinters in the soil, infection results from aerial movement of spores to the florets. Two systemic fungicides, 2,3-Dihydro-5-carboxanilido-6-methyl-1,4-oxathiin-4,4-dioxide (DCMOD) and 2,3-Dihydro-5-carboxanilido-6-methyl-1,4-oxathiin (DCMO), were found to be effective in controlling the disease. The chemicals were applied when heads had just emerged from the boot and before stigmas were showing. The heads and the top 2 feet of the foliage were sprayed until completely wet. (I) Tifton, Georgia. 331-B

Removal of DDT from Hay by Heat Treatment. DDT residues on alfalfa hay can be almost entirely removed by vapor treatment. Dry heating is very inefficient in removing these residues except when the sample is saturated with moisture. Under the investigated conditions, more than 50 percent of the initial residues on green chopped hay were removed by commercial dehydration processes. The above information forms the basis for an intentional removal of pesticides from alfalfa hay for possible utilization by commercial concerns. (E-fg) California Agr. Exp. Sta. 332-C

Insecticides to Control Alfalfa Weevil. Twenty-one new insecticides were tested against the alfalfa weevil and 5 showed promising results. They were: fention, and experimental compounds ENT-27,564, ENT-27,334, ENT-27,451 and ENT-27,448. (I) Beltsville, Maryland. 332-C

Systemic Insecticides Control Nematodes in Alfalfa. Dimethoate (0,0-diethyl 0-(4-methylumbelliferone) phosphorothioate) and cynem (0,0-diethyl 0-2-pyrazinyl phosphorothioate) gave good to excellent control of stem nematodes (Ditylenchus dipsaci) on alfalfa when applied at 0.5, 1.0, and 2.0 lbs/Acre. These chemicals may be useful in areas where climatically suited nematode-resistant alfalfa varieties have not been developed. (I) Logan, Utah. 332-F

Atrazine Fallow Increases Soil N but Inhibits Grass Seedlings. Chemical fallow using atrazine at 1 lb/acre to aid establishment of perennial grasses was effective in cheatgrass control and also permitted a 4 to 9 fold increase in nitrate-N in studies. Where control plots contained 6 lb N/acre those chemically fallowed 18 months had from 23 to 58 lb N/acre in the 0-6" depth. With only .03 to .06 ppm atrazine remaining in the soil, mortality of Amur intermediate wheatgrass seedlings was as high as 14 percent while .15 ppm atrazine permitted no seedlings to survive. In field practice 1 lb/acre atrazine applied in the fall left .31 to .53 ppm in the top inch of soil the following spring. (I) Reno, Nevada. 334-B

Grasshopper Insecticides. Low volume spray applications of Bay 39007 (8 oz per acre), Mobil MC-A-600 (5 oz per acre), and diazinon (10 oz per acre) gave adequate control of grasshoppers on rangeland. (I) Bozeman, Montana. 334-C

Control of Broomsedge in Pastures. Broomsedge is one of the most common and persistent weed problems in pastures in the Southeast. Proper management techniques nearly eliminate broomsedge as shown by research in Mississippi. Cattle grazed broomsedge when nitrogen was applied to the soil. When growth of broomsedge began to get ahead of the consumption by cattle, the extra growth was mowed at least twice during the season. In 3 to 4 years, broomsedge was almost eliminated. Dallisgrass increased as broomsedge decreased. These management practices were almost as effective as where mechanical renovation or where herbicides were used to remove the broomsedge at the beginning of the experiment and were less expensive. Nitrogen fertilization on broomsedge pastures increased protein content of young growth of broomsedge about 50 percent, whether or not the soils were also limed, or phosphate and potassium were added. (I) State College, Mississippi. 334-D

Turf Grass Diseases: Their Cause, Epidemiology and Control. A disease syndrome first recorded in 1964 and tentatively called *Curvularia* Turf Spot is now confirmed as Dollar Spot Disease, caused by a biotype of *Sclerotinia homoeocarpa*. This fungus exhibits marked resistance to thiram, cadmium, and mercury fungicides. Reports from other States indicate that this change in susceptibility by the Dollar Spot fungus to most commercially available turf fungicides is not restricted to Rhode Island. The pesticide Dyrene has been confirmed as an effective control agent for this variant of the fungus. The fungus *Ophiobolus* has been isolated from diseased Bermudagrass and is postulated as the possible cause of "Spring Dead Spot" disease. (E-fg) Rhode Island Agr. Exp. Sta. 335-B

Nematode Population Reduction and Growth Response of Bermuda Turf as Influenced by Organic Pesticide Application. Applications of 0,0-diethyl S-(ethylthio) methyl phosphorothioate (phorate), 0,0-diethyl 0-p-(methylsulfinyl) phenyl phosphorothioate (Bayer 25141), and 0,0-diethyl S-2-(ethylthio) ethyl phosphorothioate (disulfoton), at 10 lbs. active ingredient per acre gave excellent control of sting nematodes (*Belonolaimus longicaudatus*) on bermuda turf for 7 months. Applications of 1,2-dibromo-3-chloropropane (DBCP) and 0,0-diethyl 0-(2-isopropyl-4-methyl-6-pyrimidinyl) phosphorothioate (diazinon) at 86 and 40 lbs. active ingredient per acre, respectively, reduced *B. longicaudatus* populations. Applications of 0,0-diethyl 0-2 pyrazinyl phosphorothioate (cynem) failed to reduce numbers of *B. longicaudatus*. Sod density and turf greenness were best and growth of spurge (*Euphorbia maculata* L.) was least where populations of *B. longicaudatus* were smallest. (I) Tifton, Georgia. 335-F

Weed Control Increases Birdsfoot Trefoil Yield. When trefoil is seeded alone weeds are often a problem, but they can be controlled by post emergence application of herbicides. Forage yields from herbicide treated plots were 30 percent greater than from untreated plots. However, when birdsfoot trefoil is seeded with grass, a post-emergence application is of little value unless broadleaf weeds are abundant. (I) Beltsville, Maryland. 336-D

Control of Nutsedge in Oilseed Crops. Nutsedge robs peanut and soybean producers each year. It is not susceptible to most herbicides that can be used safely in peanuts or soybeans. One exception is the herbicide vernolate. Injection of vernolate in the soil at planting provides effective and safe control of this prolific pest. Successful use of the herbicide requires precision placement in the soil which is made possible through devices such as the knife-type injector. (I) Tifton, Georgia. 34-D

Soybean Yield Insect Control Increases. Soybeans treated with DDT + parathion yielded 38.4 bushels per acre compared with 22.1 for the untreated check. Plots treated with carbaryl yielded only 12.3 bushels due to spider mite damage and phytotoxicity. (I) Columbia, Missouri. 341-C

Weed Competition Tests. When morning glories or carbugrass were the major weeds present, maximum soybean yields were obtained when weeds were removed 4 weeks following planting and were kept weed free the remainder of the season. If pigweed was the predominant weed, the best yields and stands were obtained by removing the weeds 2 weeks earlier. This test was designed to determine the type of herbicide needed for optimum control. (E-fg) Delaware Agr. Exp. Sta. 341-D

Chloroxuron Found Effective Against Morning Glory in Soybeans. Annual morning glory, a serious weed in soybean fields, is resistant to many selective herbicides. The herbicide, chloroxuron, was found to be effective against morning glory in soybeans. Stage of growth when sprayed influenced soybean tolerance and morning glory control. (E-fg) Maryland Agr. Exp. Sta. 341-D

Reduction of Overwintering Population of Boll Weevils. A 99 percent reduction in the numbers of boll weevils in an 8-county area of West Texas has been produced by an insecticidal spray program aimed at reducing the overwintering population. This program has practically eliminated the boll weevil from the High Plains of Texas and has prevented the westward migration of the pest into a presently uninfested area which produces almost 2,000,000 bales of cotton per year. The great success of the control program was due, for the most part, to studies which provided precise information on the seasonal onset and incidence of diapause in the boll weevil population of the affected area. This allowed for better timing of the insecticidal treatments and greater percentages of the potential diapausing weevils were killed than in earlier programs of this type. (E-fg) Texas Agr. Exp. Sta. 351-C

Ultra Low Volume Spraying of Cotton. The rotary disc sprayer for applying ultra low volume (ULV) concentrates was improved by modifications made this year. The ULV applications gave better boll weevil control than conventional applications, using Guthion as the insecticide. (I) State College, Mississippi. 351-C

Granulosis Virus of Cotton Bollworm. A granulosis virus of Heliothis zea (Bollworm) was isolated and identified. In the laboratory it was found that certain stress factors (starvation, Bacillus thuringiensis) induced the infection in otherwise healthy-appearing larvae. These observations suggest that this virus may behave as an attenuated infection, i. e., an infection which is not followed by overt disease but which may be induced or activated to become a progressive infection. This disease may play an important role in the response of larvae of H. zea to control by chemical insecticides in the field. (E-fg) California Agr. Exp. Sta. 351-C

Soil Characteristics Influence Insecticide Uptake by Cotton. The effect of five soil mixes, two systemic insecticides, and pesticide rate upon cotton growth and upon efficacy against aphid shows: (1) The systemic uptake of soil applied Temik and NIA 10242 is mainly influenced by soil clay; (2) their persistence in cotton depends on both soil clay content and soil organic matter content; (3) the degradation of these carbamate soil insecticides is increased by higher soil organic matter contents; (4) compound, NIA 10242, was less effective for aphid control than Temik; (5) phytotoxicity was most severe on plants grown on low clay content soils; and (6) compound, NIA 10242, was more injurious on cotton than Temik. An understanding of the environmental effects on systemic insecticide performance will aid in construction of insecticide use recommendations. (E-fg) California Agr. Exp. Sta. 351-C

Interaction of Azodrin and a Nuclear Polyhedrosis Virus of H. zea. In a replicated field experiment the following treatments were compared: (1) Azodrin; (2) virus; (3) Azodrin and virus (not combined) first application, followed by repeated applications of virus; and (4) an untreated check. The applications were made at about weekly intervals from August 4 to September 22. The conclusions from this experiment were that one application of Azodrin followed by multiple applications of virus were comparable to multiple applications of Azodrin alone and superior to multiple applications of virus-alone. The initial application of Azodrin apparently reduced the bollworm infestation sufficiently below economic levels and subsequent applications of virus controlled the worms before they caused economic damage. (E-fg) California Agr. Exp. Sta. 351-C

Incorporating Trifluralin in Soil. Trifluralin applied and incorporated with a disk harrow up to 30 days before planting resulted in good weed control and did not affect yield or stand of cotton. Varying amounts of water from 7-1/2 to 45 gallons per acre when applying and incorporating trifluralin with a power driven rotary tool resulted in no difference in weed control. Incorporating trifluralin from one to five inches deep with five different tools was equally effective for control of weeds and was better than no incorporation. (E-fg) Alabama Agr. Exp. Sta. 351-D

Herbicide Application Equipment. Three types of liquid herbicide subsurface applicators were compared with a surface applicator for controlling weeds in cotton. The subsurface applicators included soil incorporators, knife injectors, and subsurface sweep-type applicators, while the surface applicators consisted of a conventional drop nozzle mounted behind the planter press-wheel. Field tests indicated that crop tolerance and control of specific weeds are definitely affected by method of application. There was a drastic reduction in injury to cotton plants when certain herbicides were injected in the soil as compared with incorporation or surface application. Soil incorporation

soil injection and subsurface application were superior to surface application with respect to cocklebur control. (I) Stoneville, Mississippi. 351-D

An Oxime Compound Gave Best Control of the Reniform Nematode (*Rotylenchus reniformis*) on Cotton of all chemicals tested, increasing seed cotton yield 207 and 502 lbs per acre for Deltapine smooth leaf and Bayou, respectively. The Bayou variety though resistant to root-knot, is highly susceptible to the reniform nematode. In California, furrow applications at conventional insecticide application rates of this oxime did not give detectable root-knot control or increase cotton yields; therefore, for nematode control higher dosages are required with this chemical. In Georgia, at planting in-furrow treatments with the oxime and the organophosphate gave good root-knot control and increased cotton yields more than 30 percent. When a herbicide was applied alone, or in combination with the nematocide, there was an increase in postemergence damping-off caused by the important fungus pathogen, *Rhizoctonia solani*. (I) Baton Rouge, Louisiana. 351-F

Studies on the Interaction of Herbicides and Nematocides on Cotton Show That Root-Knot Nematode Injured Cotton Plants Were More Susceptible to Phytotoxicity from two commonly used herbicides; highest cotton yields were attained where nematocides alone were used, and lowest for herbicides alone; mixtures of nematocides and herbicides were much better than the herbicide treatment alone. Combinations of specific pesticides for control of multiple pests (nematodes, fungi, and weeds), continues to give good results in Georgia when the chemicals are applied as broadcast, surface applications, and mechanically incorporated. A mixture of an oxime, a carbamate, and a chlorinated benzene-organic mercury combination gave good multiple pest control, outstanding tomato plant growth, and stands, which was about equal to wide-spectrum soil fumigants at less than one-tenth the cost. (I) Lubbock, Texas. 351-F

Improving Vacuum Fumigation. Observations on the efficacy of some commercial vacuum fumigations revealed that neither HCN nor acrylonitrile was giving consistent kill of fourth-instar cigarette beetle larvae at depths greater than 10 inches in tobacco hogsheads. HCN appeared to be slightly more effective than acrylonitrile at the dosages used. The penetration and kill were improved by: (1) Fumigating at 1-1-1/2 inches of absolute pressure instead of 4-10 inches, (2) increasing the temperature in the fumigant volatilizer to 210-215° F. rather than 150°, and (3) reducing the flow rate of fumigant through the volatilizer. (I) Richmond, Virginia. 36-C

Candidate Insecticides for Cigarette Beetle. Eight compounds were evaluated against adult cigarette beetles. The residue of Geigy 12968 was still effective after aging 24 months. Compounds with residues effective 6 to 12 months were Bayer 37343 and Bayer 77488, Shell SD 8211, and Shell 8447.

Ciba 2428 was the only compound with significant vapor toxicity. None was effective as a repellent or attractant. (I) Richmond, Virginia. 36-C

Protecting Tobacco in Storage. Flue-cured tobacco from the 1960 crop was fumigated each spring with HCN at 3 lb/1,000 cu. ft. and the warehouse was treated biweekly during the summer with dichlorvos aerosol. There was almost perfect protection against insect damage when the last of the crop was sold in 1967. In warehouses given the same dichlorvos treatment but more frequent HCN fumigations at a 1-lb. rate insect damage ranged from trace amounts to very heavy. Some of the tobacco sold at a discount because of excessive damage. In other tests a series of warehouses fumigated in the spring with the 3-lb. dosage of HCN and given daily dichlorvos applications remained insect-free the first summer of storage. Cigarette beetles began to appear by August of the second summer. Even with daily dichlorvos applications, a heavy fumigation may be required every second year to protect the tobacco. (I) Richmond, Virginia. 36-C

Ultra Low Volume Spray of Malathion Controls Sugarbeet Root Maggot. Three aerial sprays of 8 ounces of technical malathion per acre gave good control of root maggot infestation through destruction of adult flies in a test on over 500 acres of sugarbeets. In the past control of this insect has been with persistent insecticides applied to soil or on sugarbeet seed. (I) Twin Falls, Idaho. 372-C

Weed Control Resulting from Reduced Tillage Operations. Fewer tillage operations combined with strip-tillage techniques for sugarbeets (Nebraska Till-Plant method) without herbicides resulted in weed control as effective as conventional planting with use of herbicides. Where weeds were controlled sugarbeet yields ranged from 20 to 25 tons per acre. (E-fg) Nebraska Agr. Exp. Sta. 372-D

Horticultural Crops

Residue Removal from Fruits and Vegetables. Sweet cherries, McIntosh apples, Rome apples, Golden Delicious apples, broccoli, cauliflower, and brussels sprouts were washed and stored. The amount of pesticide removed ranged from zero to 100 percent, depending on the commodity, the washing treatment and the pesticide. With the exception of broccoli, almost all the washed commodities held up in storage just as well as the unwashed controls. This shows that the detergent chemicals that were used do not adversely affect the keeping quality of the produce in storage subsequent to washing, providing the commodity is rinsed off once in fresh water after the detergent treatment. (E-fg) New York State Agr. Exp. Sta. 41-A

Protectant Principle Explored for Dried Fruits. Results of small scale tests with malathion spray and dust treatments on figs and raisins indicate sufficient promise to carry them into larger tests. Equipment for applying protective sprays to grain is not suitable for treating dried fruits or tree nuts. A new machine was designed, constructed, and tested. It can be adjusted to apply a wide range of dosages, fits in with industrial handling conditions, and appears to perform satisfactorily. Shelled almonds were treated with this machine at 3, 8, 12, and 16 p.p.m. for a small-bin storage test. Treated almonds subjected to taste panel tests showed no significant change in flavor or odor. A preliminary test indicates that blanching to remove the seed coat eliminates a large amount of the malathion residue. (I) Fresno, California.

41-C

Dichlorvos Applicators Tested in Wineries. The vapor generator developed by the Savannah laboratory for dispensing dichlorvos was operated August through October, the period when vinegar flies and dried fruit beetles are most numerous, in a wine cellar with 268,495 cu. ft. of airspace. High humidity rapidly decreased vapor concentrations but the degree of control was promising. A test was made to compare the rate of decrease in air concentration of dichlorvos after vapor generator and thermal aerosol treatments. After one-half hour, there was 10 percent loss from the vapor treatment and 80 percent from the aerosol. After an hour the losses were 52 percent and 90 percent, respectively. Samples of sherry and tokay wines exposed in open beakers to 3 hours of vapor generator operation contained less than 0.03 p.p.m. of dichlorvos. A taste panel could detect no off flavor. (I) Fresno, California.

41-C

Viral Control of the Cabbage Looper. The influence of sub-acute virus infection in the cabbage looper, Trichoplusia ni (Hübner), on the dosage requirements for LD₅₀'s for Endrin, Thiodan, Dylox, and GC-9160 was evaluated. In these tests, the oral LD₅₀ was lowered 3-fold for Endrin and Dylox and 6-fold for Thiodan following pretreatment with the virus. The dosage requirements for GC-9160 to produce an LD₅₀ was too high for this technique. (E-fg) Georgia Agr. Exp. Sta.

41-C

Control of Vegetable and Orchard Insects. Equipment was prepared to meter and apply four different undiluted liquid insecticide formulations to vegetable crops at dosages from six to twenty-four ounces per acre. Control of green peach aphid, turnip aphid, two spotted mites, and imported cabbage worm was obtained by some of the different insecticide applications. Orchard sprays containing wettable powders at 33 to 66 times normal concentration in water were applied to apples at 0.12 to 0.24 gallon of spray per tree. Dormant oil spray was applied at 0.16 gallon per tree. Control of apple scab, European red mite, rosy apple aphid, codling moth, red banded leaf roller, and plum curculio was obtained with this type of application. (I) Wooster, Ohio.

41-C

Soil Treatment Before Planting Cherries. Recent measurements of cherry trees show that they grew much better and produced considerably more fruit in the treated soils. Subsurface linear applications of volatile nematocides were made in 1957 and 1960 prior to replanting trees in a cherry orchard. These trees have now reached bearing age and those growing in the treated soil are taller and measure 18 to 50 percent greater in crown widths than those planted in untreated soil. Weight of fruit from trees in treated plots was 37 to 156 percent greater than weight from trees in the untreated area. (I) Wooster, Ohio. 41-C

Evaluation of Herbicide-Treated Cloth. Accurate application methods for the use of herbicides on small areas continues to be a serious need. In a continuation of earlier research conducted at Beltsville, Maryland, a number of kinds of cloth materials, including cotton mats and burlap cloth treated with herbicides, have been successfully used as soil treatments to control germinating weeds. (I) Beltsville, Maryland. 41-D

Dichlobenil Gave Effective Quackgrass Control in Fruit Crops. Dichlobenil was extensively evaluated as a herbicide for quackgrass control in perennial horticultural crops. Fall application of 6 lb/A effectively controlled quackgrass without injuring apples, peaches, cherries, blueberries, grapes and brambles. This herbicide was found to inhibit the sprouting of buds on quackgrass rhizomes. Fruit trees, blueberries, and asparagus tolerated repeated applications of terbacil which effectively controlled quackgrass and other perennial weeds. A late fall application of terbacil (4 lb/A) effectively controlled slender rush in blueberry. (E-fg) Michigan Agr. Exp. Sta. 41-D

Seed Treatment of Lentils. Chemicals used as seed treatments were effective in increasing yields: methylmercury dicyandiamide, PCNB, TCNA, methylmercury nitrile, various ethyl mercury salts, and captan. A nematocide and the insecticides dieldrin and disulfoton were also effective. (I) Washington Agr. Exp. Sta. 42-B

Helicopter Spray Studies on Boom Location. Third series of tests on boom location were completed which included: (1) Ultra-low-volume (ULV) nozzle temperature studies, (2) electric Minispin nozzles, (3) vibrajet nozzles which were found unsatisfactory because of mechanical problems in aerial use, and (4) Plant Protection Ltd. orifice plates. Cooperative spray studies were conducted with ENT: (1) Pole beans were sprayed with malathion against the black aphid with helicopter vs. fixed-wing aircraft, first results favor the helicopter, (2) lima beans sprayed with ULV malathion in a single test with results satisfactory and (3) broccoli sprayed against the cabbage looper with results satisfactory. (I) Forest Grove, Oregon. 42-C

A New Urea Herbicide, Patoran, Was Outstanding for Weed Control in Potatoes. In potato experiments, a new substituted urea herbicide, Patoran, applied after drag-off, was outstanding: It was superior to the standard EPTC in control of annual broadleaf weeds and in early crop vigor. However, 1 inch of irrigation after application reduced its effectiveness for grass control slightly. A new method for applying EPTC, blade injection, improved the effectiveness of this herbicide with regard to early crop vigor as well as control of both annual grasses and broadleaf weeds. In this method the herbicide spray was applied in bands 3 in. apart and 1-1/2 in. deep. (E-fg) Delaware Agr. Exp. Sta. 421-D

Control of Bacterial Diseases of Bean. Further studies on the application of copper compounds for the control of halo and common bacterial blights in Michigan resulted in a decrease in disease development and spread. Aerial application of the materials gave better control than ground application. (I) Michigan Agr. Exp. Sta. 424-B

Control of Fungus Diseases of Bean. In Michigan a soil treatment program to control root rot using PCNB, chloronitro propane, and chloroneb immediately prior to planting failed to decrease root rot development significantly. Foliar sprays of PCNB and dichloran (1-1/4#/A) gave significantly better protection than ferbam (3#/A) + lime. (I) Michigan Agr. Exp. Sta. 424-B

Ultra Low Volume Malathion Spray Controls Lygus Bugs. Technical malathion applied to lima beans at 8 ounces per acre by fixed-wing aircraft gave excellent control of lygus bug adults and nymphs within 18 hours after treatment. (I) Forest Grove, Oregon. 424-C

Beneficial and Pest Arthropods of Lima Beans. The abundance of pest arthropods as compared with beneficial species associated with lima beans was found to be influenced by the insecticide used. Sevin and LV-malathion, respectively, caused an 80 and 85 percent reduction in phytophagous species, but only a 28 and 66 percent reduction in beneficial ones. DDT caused more than a 90 percent reduction in both phytophagous and beneficial forms. In fields treated with systemics the initial populations of beneficial, as well as phytophagous species, was low and there was only a slight increase in both throughout the season. (E-fg) Delaware Agr. Exp. Sta. 424-C

Residue Removal. In a study of southern peas contaminated with DDT, it was determined that while the entire pod contained the pesticides, the majority was found in the hull portion. Thus, removal of the hull resulted in a decrease from 2.3 ppm to 0.076 ppm in the shelled peas. Pressure cooking of the shelled peas (autoclaving at 121° C. for 10 minutes) effected a further reduction to 0.019 ppm DDT. In a similar study of southern peas contaminated

with heptachlor, it was found that in the entire pod and shelled peas the heptachlor had undergone a partial conversion to heptachlor epoxide. Removal of the hull again resulted in a large reduction of the pesticide from the product. In the shelled peas more than half of the pesticide was present as the epoxide. Autoclaving had an adverse effect in that it caused a further conversion to the more toxic epoxide (to the extent of 90 percent) while it afforded no removal of the pesticide. (E-fg) Texas Agr. Exp. Sta. 424-C

Excellent Weed Control With No Reduction in Crop Quality and Yield of Lima Beans Was Obtained with Trifluralin, Amiben and Sindone. (E-fg) Utah Agr. Exp. Sta. 424-D

DDT Removal from Spinach. Processed spinach samples were analyzed for DDT residues using Gas Chromatographic techniques. Variations in the unit operations of washing and blanching were made. The results indicated that the residue at 15 days after application was reduced by 50 percent in the finished product when the raw product was washed in water and blanched in hot water. A reduction of 75 percent was obtained by water washing and steam blanching or by detergent (2500 ppm) washing and hot water blanching. When detergent was added to the wash water prior to steam blanching, the reduction of residue was 80 percent. At 30 days after application the removal of residue by washing without detergent and hot water blanching was 75 percent, while washing without detergent and steam blanching removed 90 percent of the residue. The addition of detergent to the wash water prior to either steam or water blanching gave complete removal. (E-fg) Ohio Agr. Exp. Sta. 427-C

Improved Methods for Control of Weeds in Asparagus. The herbicide monuron has been used extensively to control many weeds in asparagus plantings for a number of years. There have been some indications in New Jersey that stand and quality of the crop has been reduced by the use of monuron. Research is in progress to study this effect and to study the herbicidal effectiveness of, and crop response to, alternate herbicides. Simazine, linuron, DCPA, and terbacil have given outstanding weed control without injuring the crop in the preliminary phases of this research. The studies will be continued to determine the effects of continued use of these alternate herbicides on crop longevity, quality, yield, and metabolism. (I) New Brunswick, New Jersey. 429-D

Vernolate Controls Nutsedge in Southern Peas. Nutsedge is a perennial weed that infests many row crops, including southern peas, in the Southeast. It cannot be controlled by mechanical cultivation and is, therefore, a serious threat to production of these crops. In research at Tifton, Georgia, a small amount of vernolate applied as a subsurface placement in the soil after southern peas have reached the 5 to 6 leaf stage of growth, controlled more

than 90 percent of the nutsedge and other weeds without injuring the crop. Rotations using plantings of southern peas treated with vernolate may prove to be a means of bringing nutsedge under control so that other crops can be grown without vernolate in alternate years. Research is continuing.
(I) Tifton, Georgia. 429-D

Plant Extracts Inhibit Stone Fruit Viruses. Water-soluble extracts from 50 of 59 plant species known to have anticancer activity gave 60 percent or greater inhibition of necrotic ringspot virus and 30 inhibited tobacco mosaic virus. Of these 13 species inhibited NRSV only and 7 species inhibited TMV only. These extracts offer hope for the recovery of, or synthesis of, chemotherapeutic compounds to free affected trees of virus or to inhibit their multiplication in the tree. (I) Wenatchee, Washington. 43-B

Systemic Effects on Bacterial Diseases. It has been determined that the hypersensitive reaction in plant tissue as induced by phytopathogenic bacteria required the presence of living intact bacteria. The hypersensitive reaction could not be induced by bacterial cell fragments, heat killed cells or the metabolites of bacteria in vitro or in vivo. Induction time for this reaction was between 0-20 minutes and was irreversible after that time. The glandular trichomes are an important pathway for the entry of Erwinia amylovora into leaf tissue. The minimal number of cells of this bacterium required to cause systemic infections from leaf inoculation is 250-500 cells. Since the aphid, Aphis pomi, can inoculate not more than 150 bacterial cells into the leaf, it is probably not an efficient vector of this pathogen. (E-fg) Missouri Agr. Exp. Sta. 43-B

Peach Leaf Curl and Brown Rot Control. A series of three dilute preharvest sprays were applied to Hale Haven peaches at weekly intervals immediately prior to harvest. After the final spray trees were exposed to one-inch of rainfall. The sampled fruit was inoculated with the brown rot and Rhizopus rot fungi and exposed to conditions suitable for spread of infection. Peach fruit from unsprayed trees developed 92 percent brown rot in four days and 75 percent Rhizopus within six days. Despite the depletion of spray residue by rain water the Orthocide (captan) and Botran fungicides held brown rot down to about 35 percent. Botran was unusually effective in the prevention of the development of sporulating aerial mycelium of Rhizopus. Captan was somewhat less effective against this fungus. The experimental broad-spectrum fungicide Daconil-2787 was fairly effective against both rots but caused dark brown blotch injury to the skin of peaches exposed to moist conditions and temperature of about 73° F. (E) New York Agr. Exp. Sta. 431-B

Host-Parasite Interaction in Relation to Control of Bacterial Diseases of Fruit. A yellow pigmented form of bacteria has been associated with the fire blight organism Erwinia amylovora. The yellow isolates closely resemble Xanthomonas pruni. It has been verified that the yellow bacteria do not belong to the genus Erwinia. In field studies, weekly night applications of streptomycin at 50 ppm gave nearly perfect control of fire blight on Jonathan twigs. Streptomycin has not heretofore been considered effective except for prevention of blossom blight. It is believed that this method of application increases leaf absorption of the antibiotic since streptomycin chlorosis was evident. (E-fg) Illinois Agr. Exp. Sta. 433-B

Controlled Atmosphere Storage of Apples. Continued observation on the incidence of decay of apples in controlled atmosphere (CA) storage indicate an average of 1.0 percent storage rot. Differences in percentage decay among storage rooms does not appear to be associated with the minor fluctuations in O_2 and CO_2 content of the atmosphere. Penicillium expansum is the most frequently isolated pathogen. The incidence of storage rot in MacIntosh apples is least in fruit picked prior to or at the predicted optimum harvest date. Isolates of Penicillium expansum produced pectinolytic and cellulolytic enzymes when grown at both $3^{\circ}C$. and $20^{\circ}C$. The relation of ability to produce these enzymes to virulence of isolates is not clear. Observation of losses in CA storage have suggested fungal rots can be controlled by management practices. Fruit to be stored in CA should be harvested prior to or at the predicted optimum date. (E-fg) Vermont Agr. Exp. Sta. 433-B

Weathering of Experimental Insecticides on Apples. The effect of normal weathering on Shell SD-8447, Niagara NIA-10242, General Chemical GC-6506, carbaryl, and azinphosmethyl after 3 cover sprays was determined by field-laboratory bioassay. Two-hour-old deposits of all treatments were 100 percent effective against larvae and adults of both codling moth and red-banded leaf roller. GC-6506 was still effective against larvae of the codling moth after 22 days of weathering. SD-8447 and azinphosmethyl were effective against larvae of the red-banded leaf roller after 22 days. Only NIA-10242 was effective against adults of either species after 14 days of weathering. (I) Vincennes, Indiana. 433-C

Use of Gibberellin Sprays to Alleviate Sour Cherry Yellows Leaf Symptom and to Increase Yields of Diseased Trees. Gibberellin sprays, properly balanced with tree fertility, offer a means of maintaining economic production in sour-cherry-yellows-infected trees. Although yellows-free trees respond better than infected ones, gibberellin tends to counteract the disease symptoms and to permit the production of marketable volume of fruits on infected trees. The sprays tend to reduce leaf size and reduce terminal growth, in addition to the desired effect of increasing fruit set. (I) Madison and Sturgeon Bay, Wisconsin. 436-B

Organic Phosphate Dip Treatments of Citrus Nursery Stock for Nematode Control. Bare-root dips at 800-1000 ppm of cynem (0,0-diethyl 0-2-pyrazinyphosphorothioate) and Bayer 25141 (0,0-diethyl 0-p-(methylsulfinyl) phenyl phosphorothioate) gave nearly 100 percent control of burrowing nematodes (*Radopholus similis*) in roots of citrus seedling up to 18 months old. Seedling freed of nematodes by chemical treatment showed marked growth increases, compared with nontreated, infected-plants. This method of control has promise as an additional safeguard in preventing the spread of burrowing nematodes in citrus nursery stock. (I) Orlando, Florida. 44-F

Studies Were Completed in Arizona to Determine the Rate of Kill of Nematodes by a commonly used halogenated hydrocarbon in irrigation water; 85 percent of the nematodes are killed 10 days after irrigation with the nematocide, 97.5 percent after 20 days, and 99.7 percent after 60 days exposure. Mixtures of nematocides show promise for improving nematode control. In Arizona, mixtures of a chlorinated organic sulfur compound with this same halogenated hydrocarbon gave better root-knot control than either chemical alone, because the latter has higher volatility and gave quick kill, long-lasting seasonal control was given by the former. (I) Phoenix, Arizona. 44-F

Ultra Low Volume Bait Spray Controls Mexican Fruit Fly. Bait sprays of technical malathion in PlB-7 (protein hydrolysate) 1:4 were applied at 6.7 oz/acre weekly to alternate trees in a 5.6 acre navel orange grove. Applications were made with a standard knapsack sprayer from January until harvest in May. Infestation at harvest was reduced by 86 percent in picked fruit and 96 percent in fallen fruit compared to that in a check grove of 7.2 acres. (I) Mexico City, Mexico. 441-C

Commercial Use of Treated Raisin Drying Trays. About 10 million malathion-treated paper raisin drying trays were used by industry for the 1966 crop, the first year they were commercially available. The trays were to have been treated with 100 mg. of malathion per sq. ft. They contained an average of 60 mg./sq. ft. when placed in the vineyards. Raisins dried on the trays contained about 3.5 ppm of malathion, well within the 8 ppm tolerance and enough to protect the raisins against insects during storage prior to processing. The industry was enthusiastic about the performance of the trays. An estimated 22 million trays were used for the 1967 crop. This involved almost one-fourth of the total raisin production. (I) Fresno, California. 451-C

Sinbar Was Effective in Controlling Weeds in Strawberries. Among several effective strawberry herbicides sinbar (terbacil) was particularly promising in 1965-66 results. As little as 0.4 lb/A controlled summer weeds when applied after planting and winter weeds when applied in the late fall, without

symptoms on the berry plants. Quadruple doses in the fall injured the youngest daughter plants, but not the productive older ones. (E-fg) New York State Agr. Exp. Sta. 452-D

Nematodes Were Effectively Controlled in Container-Grown Plants by Drench or by bare-root dips of several ornamentals with three organophosphates and the same oxime. These chemical treatments have been so successful in ridding citrus seedlings and ornamental plants of burrowing nematodes that the Plant Pest Control Division and the Florida Department of Agriculture are in the process of accepting bare-root dips with these chemicals in lieu of the expensive preshipment site-certification for citrus nurseries. In Georgia, tractor applied sidedressings of liner grown ornamentals with the same chemicals were less effective. (I) Tifton, Georgia and Orlando, Florida. 46-F

Investigations of Damping-Off and Root-Rot Diseases of Greenhouse Floral Crops. Research continued in the evaluation of techniques for potential use in bioassaying soils for residual toxicity of soil fungicides. Results indicate that the paper-ring technique has promise for use in assays for fungitoxicity. Studies of volatile fungicides were expanded to include a new fungicide Daconil 2787. This fungicide sublimates upon heating and, as the vapor cools, it is deposited as a fine dust. The term "thermal dusting" has been applied to this method of fungicide application. (E-fg) Ohio Agr. Exp. Sta. 461-B

Forests

Natural Durability in Wood. Many woods are naturally more resistant to decay than the best preservative-treated wood of nondurable species. Experimentation and a search of the literature disclosed 54 tree species in which fungus-inhibiting extractives of phenolic nature could account at least in part for natural decay resistance of the heartwood. Lesser resistance of inner heartwood is believed to be largely attributable to oxidative changes of the extractives to less potent compounds. The naturally occurring extractives offer valuable clues to means of substantially improving preservative treatments. (I) Madison, Wisconsin. 5-B

Herbicidal Control of Dwarfmistletoe. Two herbicides show some promise for development of satisfactory control of dwarfmistletoes on pine in California. The material 2,4,5 - trichlorophenoxy butyric acid appears promising as a direct control, and 2,4,5 - trichlorophenoxy propionic acid as a systemic control. (I) Berkeley, California. 5-B

Fungicides Offer Only Temporary Protection Against Annosus Root Rot. Evaluation 4 years after large-scale stump treatment studies with ammonium fluoride and creosote showed a higher percentage of treated stumps to be infected with Fomes annosus than non-treated. A 3-month evaluation of these North Carolina studies had indicated almost complete control with both chemicals. Trichoderma spp., reported to be effective antagonists against F. annosus, were isolated from all fluoride-treated stumps. (I) Research Triangle, North Carolina. 5-B

Fungicides Control Blight of Shelterbelt Conifers. Blight caused by Cerco-spora sequoiae is a serious threat to established plantings (shelterbelts) of eastern redcedar and Rocky Mountain juniper in eastern and central Nebraska. Good control of this fungus was obtained with three to five applications of Bordeaux mixture (8-8-100) applied at 3-week intervals beginning in early May. (I) Lincoln, Nebraska. 5-B

Proper Timing of Fungicide Applications. The key to the amount of damage to pines by fusiform rust in the amount of fungus inoculum on the oak alternate hosts. The time during which this inoculum is produced also delineates the period of maximum infection hazard to the pines. Maximum germinative capacity of the oak inoculum occurred in South Carolina within a 3-week period from late April through mid-May. The production of inoculum declined after that, and by June had essentially stopped. Thus, pines are relatively safe after a brief period in the spring. Application of fungicides could safely be limited to this period of high-infection hazard. (I) Asheville, North Carolina. 5-B

Safer Fumigants for Control of Forest Nursery Pests. Forest nurseries have for many years used soil fumigants for controlling soil-borne seedling diseases and weeds. The materials currently used require a plastic cover over treated nursery beds in order to be effective. A new material, with a mixture of dichloropropanes and methyl isothiocyanate as the active ingredients, was tested at Athens, Georgia. Without a cover it was not as effective as the standard treatment with methyl bromide but with a cover it was equal to methyl bromide. Nurserymen may prefer the new fumigant because it is easier and safer to handle than many other fumigants. (I) Athens, Georgia. 5-B

Translocation and Assay of Antibiotics in White Pine. Partially purified Phytoactin and its purified components, A and B, were labeled with radioactive tritium in order to trace their movement in white pine seedlings. Five days after application, on current and mature needles and at the stem base, increased radioactivity was noted in different portions of the upper crown. The pattern of distribution indicates selective accumulation of radioactivity in mature needles and suggests that Phytoactin can act in a systemic

manner. Phytoactins A and B can be extracted and assayed (against the test fungus Glomerella cingulata). Concentrations of Phytoactin B as low as 1/2 ppm in tissue can be assayed; Phytoactin A is difficult to detect below 250 ppm. (I) Moscow, Idaho; and (E) Washington State University. 5-B

Behavior of Tree Roots in Relation to Their Environment. Fumigation of acid tree nursery soils with methyl bromide at rates of 300 or 600 pounds per acre resulted in the growth of significantly larger loblolly pine seedlings than in plots fumigated at 150 pounds per acre or receiving no fumigation. Chemical analysis of the soil revealed no fumigant-induced changes that could account for the growth differences. Uptake of Fe, Mn, and Al (on both a concentration and a per seedling basis) was directly related to fumigation rate. Soil fungi were almost completely eliminated to a depth of six inches by treatment of 300 and 600 pounds per acre. The application of a pine needle mulch greatly influenced the recolonization of the surface soil by saprophytes and mycorrhizal fungi. This treatment did not affect fungal populations at the 3-4 or the 5-6 inch depths where the fungal population remained low and at a fairly constant level. Pathogens such as Fusarium, Cylindrocarpon, Phoma, and Coniothyrium were common on roots grown in non-fumigated soil but were rare on roots from fumigated soil. (E-fg) North Carolina Agr. Exp. Sta. 5-B

Abnormal Physiology and Control of Vascular Wilt Diseases of Trees. Various systemic chemicals have been applied to elm trees for control of the Dutch elm disease caused by Ceratocystis ulmi. At the time of bud break the trunks of 60 American elms were banded six-inches wide at breast height with an aqueous solution of TCPA. Segments of three-year old branches from treated and untreated trees were excised, sectioned, and examined to determine the effect of TCPA on spring wood development before inoculation with the pathogen. At the full-leaf stage 60 American elms and 8 "resistant" elms were branch-inoculated with a composite suspension containing five isolates of the fungus. TCPA-treated trees exhibited symptoms similar to 2, 4-D injury. Treated-inoculated trees showed symptoms later than untreated-inoculated trees. Inoculated European elms failed to develop foliar symptoms, but sapwood discoloration appeared above and below the infection site. (E-fg) Rhode Island Agr. Exp. Sta. 5-B

Strawberry Root Weevil Control in a Douglas-Fir Seed Orchard. A strawberry root weevil, Brachyrhinus ovatus caused severe damage in a Douglas-fir seed orchard on the Siuslaw National Forest, Oregon. The infestation was successfully controlled by mechanical means (plowing and discing) and a light application of chemical. The soil tilling in combination with pesticide application resulted in cancellation of a second scheduled pesticide application. (I) Portland, Oregon. 5-C

Reduction of Bark Beetles by Herbicides. Studies were made in 1967 on the use of a fast-acting herbicide to reduce bark beetle broods in naturally infested trees. The application of the herbicide was simplified by frilling the trees near the base with an ax and introducing the chemical into the sap stream with a plastic squeeze bottle. In related studies, the herbicide was used to kill standing green host trees prior to beetle flight. This apparently attracted the bark beetles, which attacked the trees, constructed galleries, and laid eggs. In many instances, the parent beetles were killed and the brood failed to develop. (I) Albuquerque, New Mexico; Denver, Colorado; and Portland, Oregon. 5-C

Several Insecticides Found to be Toxic to Spruce Budworm. About 40 insecticides were tested in the laboratory against the spruce budworm in 1966. The 10 most toxic compounds were: Pyrethrins, Zectran, mevinphos, Dursban, dichlorvos, GC 6506, S 4084, parathion, Matacil, and Imidan. All of these compounds and several others were more toxic than DDT. Attempts to synergize Zectran with 21 different compounds failed. Zectran as a spray is only slightly more toxic to the second, third, and fourth instars than to the fifth and sixth instars and pupae. It is about 10 times more toxic topically than when administered in an artificial diet. (I) Berkeley, California. 5-C

Pilot Tests of Zectran. Continuing efforts to find a non-persistent insecticide to replace DDT for spruce budworm control led to further field tests of the carbamate insecticide, Zectran, in 1967. The results of these tests were encouraging, averaging about 85 to 87 percent reduction in budworm populations with no measurable adverse effects to fish populations or terrestrial animals. A further test of Zectran applied at one ounce actual per acre in droplet sizes as small as possible with available spray equipment is planned for 1968. If results of this test are favorable, Zectran will be recommended for operational use against the spruce budworm. (I) Ogden, Utah; Upper Darby, Pennsylvania; and Berkeley, California. 5-C

Engelmann Spruce Beetle Control. One method of suppressing Engelmann spruce beetle populations involves felling green spruce, waiting until they are infested by the beetle, and then removing the infested trees from the woods. This method requires careful timing to insure that the infested trees are removed before the contained brood can leave to attack standing green trees. A modification of the "trap tree" method shows promise of eliminating the need to remove the "traps" from the woods. A month prior to beetle flight, green trees were poisoned with a fast-acting herbicide. Two weeks later the trees were felled and were subsequently infested with Engelmann spruce beetle. Preliminary evaluation results showed that at least 90 percent of the brood failed to develop in the poisoned "traps". (I) Albuquerque, New Mexico; and Denver, Colorado. 5-C

Low Volume Malathion Controls Jack-Pine Budworm. In Michigan, a pilot insecticide test was directed against the jackpine budworm. Malathion low-volume concentrate was applied by air at the rate of 13 fluid ounces per acre. Results showed an average population reduction of 76 percent when counts were corrected for population changes in the untreated plots. This compares favorably with malathion high-volume applications used in the past. (I) St. Paul, Minnesota. 5-C

Small Droplets Most Effective Against Budworm. By means of a fluorescent tracer technique, it was found that the drop sizes most effective against the spruce budworm were those under 50 mmd. (mass-median diameter). This finding has led to a new type of aerosol treatment with Zectran that will be pilot tested in 1967. If successful this treatment could provide a method for selective control of budworm and replace the DDT treatment applied in the past. (I) Berkeley, California. 5-C

Light Traps Measure Activity and Abundance of Seed Insects. Ultraviolet (blacklight) light traps of an improved design provided basic information in 1966 on the seasonal activity and relative abundance of seed-destroying insects in the South. This information will be used to improve insecticide spray schedules for seed orchards. As a result of this research, blacklight traps are also being employed as a detection method for evaluating the species' composition and geographic distribution of destructive insects in seed orchards throughout the South. (I) Olustee, Florida. 5-C

Malathion Spray Controls Sheath Miner. The pine needle-sheath miner in California was effectively controlled by a water emulsion spray of malathion applied by helicopter at the rate of 1 lb. of insecticide in 25 gallons of water. Numbers of insects were reduced by nearly 99 percent 24 hours after treatment. (I) Berkeley, California. 5-C

Baygon Granules Control Spittlebug Nymphs. It has been demonstrated that the Saratoga spittlebug can be controlled in the nymphal stage with chemicals. This insect is normally controlled in the adult stage with DDT or malathion. A pilot test revealed that spittlebug nymphs were eliminated from 30 test plots following the application of granular Baygon at the rate of 3 lbs. per acre. This is particularly important because the timing for control of the nymphs is far less critical than the timing for the adults. (I) St. Paul, Minnesota. 5-C

Systemic Reduces Insect Damage to Cones and Seeds. Field experiments with the systemic insecticide Bidrin, injected into 80-foot-tall slash pine seed production trees in early May 1966, reduced attacks by Dioryctria cone-worms and the slash pine seedworm by 93 and 99 percent, respectively,

during the final 4-1/2 months of cone development. This approach shows promise for reducing the number of insecticide applications, lowering costs, and eliminating the need for precise timing of sprays. (I) Athens, Georgia. 5-C

Granular Mirex Bait Effective Against Texas Leaf-Cutting Ant. The Texas leaf-cutting ant is a serious economic pest in the upland forests of east Texas and west central Louisiana. Regeneration of pine is impossible in some cases without thorough control of the colonies for several years. A granular bait containing mirex, a slow-acting stomach poison, will stop foraging activity within five days and destroy the colony within 30 days. Mirex is a surer method of control than fumigation, and it can be applied year long, is safer, and cheaper. (I) Alexandria, Louisiana. 5-C

Attempt to Control Cedar Shoot-Borer. Chemical treatments of a sudden outbreak of the cedar shoot-borer, using Endrin and Disyston failed to provide control. It is believed that treatment timing is critical. Green fruits of cedar are being selected to develop further information on infestation cycles. Apparently the pest has two cycles per year. (E-fg) Puerto Rico Agr. Exp. Sta. 5-C

Arboreal Termites in Puerto Rico. In the Puerto Rico project on arboreal termites, host trees of Nasutitermes costalis now number 142, while N. nigriceps number 102. Surveys made in the Virgin and other Caribbean Islands confirm the hypothesis that nigriceps is a dry area species, while costalis prefers humid areas. Tests for control of both species of termite by spraying with Aldrin, Dieldrin, Chlordane, or Heptachlor shows some promise. (E-fg) Puerto Rico Agr. Exp. Sta. 5-C

Protection Against Nantucket Pine Tip Moth. Several systemic insecticides applied for control of the Nantucket pine tip moth provided protection, but of short duration. Granular formulations applied to the soil gave longer periods of protection but were slower in action. Some phytotoxic effects were noted. (E-fg) Oklahoma State University. 5-C

Reduction of Seed Losses. The introduction of a systemic insecticide methyl demeton, into trunks of Douglas-fir by means of "Manget Tree-Injector Units" was proved feasible. Significant reductions were obtained in insect-caused seed losses in open-growing, pole-size trees. Seed losses from all causes in treated trees averaged 20 percent of losses in untreated trees. Two grams of insecticide per diameter inch was used; one gram gave inconsistent results. (E-fg) University of Idaho. 5-C

Killing Effects and Translocation of Stem Injected Herbicides Studied. Study of poisoned northern hardwoods found that death was from vertical translocation not lateral movement. Herbicides move upward in the outer sapwood to the foliage and appear to be translocated back down the tree to the root system through the phloem if sufficient quantities of the chemical are present. The lack of lateral movement explains some of the failures of treatments to give complete kills, particularly where large crowned trees are involved. Application of this knowledge suggests that chemicals should be applied as high on the stem as convenient to reduce number of injections and better tailored dosages can be applied by taking crown size into consideration.

(I) East Lansing, Michigan.

5-D

Use of Weed Control at Planting Time. The development of planted black walnut, yellow-poplar, and hybrid poplar in Indiana continues to show response to weed control and fertilization in the root zone at time-of-planting. On bottomland sites, the reduction of weed competition, especially by chemical control, stimulates early growth of seedlings, with foliage of improved size, color, and nitrogen content. Hybrid poplar with weed control after two seasons averaged 17 feet in height and 1.8 inches in diameter, while trees on untreated areas were 11 feet in height with less than 1 inch diameter. Black walnut on a clean cultivated site attained heights up to 10.6 feet in three years. Also these field trials have revealed problems worthy of investigation for production of high-quality black walnut. (E-fg) Purdue University.

5-D

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TARGET IV

TO STUDY THE TOXICITY, PATHOLOGY AND METABOLISM OF PESTICIDES AND INVESTIGATE LEVELS, EFFECT, AND RATE OF THEIR RESIDUES IN PLANTS, ANIMALS AND THEIR PRODUCTS, AND IN THE ENVIRONMENT

General

Dynamics of Fungicidal Action. Considerable effort is being placed on the search for antispোরulants using Alternaria solani. Active materials fall into several groups of metabolic inhibitors. Certain compounds, known to be inhibitors of cell division and nucleic acid synthesis have been detected. For example, analogs of purines, pyrimidines, and carbonic acid, have shown antispোরulant activity. Diverse compounds including phenols, fatty acids, and guanidines which uncouple high energy phosphate bonds, have shown activity. Chlorinated phenols, which may compete with phenols of the fungus for the enzyme phenolase, also inhibit sporulation. Ethionine, and antilog of methionine is a very active antispোরulant; however, the following respiratory inhibitors had no effect: Malonic acid, sodium arsenite, sodium fluoride, potassium cyanide, sodium azide, and hydroxylamine. Such results suggest that the metabolism of sporulation requires a large concentration of high energy phosphates, requires a respiratory path that includes the glycolate--glyoxalate reaction and phenolases, and requires the synthesis of nucleic acid. Sporulation apparently does not involve the citric acid cycle nor the cytochrome system. (E-fg) Connecticut Agr. Exp. Sta. 1-A

Solubility of Chlorinated Hydrocarbon Pesticides. As a result of temperature-solubility studies, it has been shown that a stable colloidal suspension may be most realistic when considering the behavior of slightly soluble chlorinated hydrocarbons. Their entry into bodies of water probably occurs in conjunction with particulate matter to the same extent as by the "in solution" path. A 30-degree change in temperature can change the amount in solution of some of these materials by as much as 7 times. Thermodynamic theory to describe this has been tested and found adequate. (E-fg) California Agr. Exp. Sta. 1-A

Diffusion of Pesticides in Soil. Nine methods of incorporating prometryne or amiben in a soil medium were compared in the search for a procedure which would give a homogeneous distribution. Equilibrium periods of 2 and 4 weeks were used for each treatment with the soil packed in lucite cores and kept at a constant temperature and in the absence of light. The cores were partitioned and the ^{14}C activity determined for each segment. The data showed that all methods gave equal homogeneity for amiben and 7 of the 9 were equal for prometryne. Self diffusion experiments using cotoran were initiated. The diffusion of cotoran in Crowley silt loam resulted in a coefficient of the order of $5 \times 10^{-8} \text{cm}^2/\text{sec}$. The distribution curve indicated a very erratic movement of cotoran as though degradation had taken place. (E-fg) Arkansas Agr. Exp. Sta.

1-A

Technique Developed to Measure Growth Responses of Bacteria to Simazine. Growth responses of 18 strains of nitrate reducing bacteria to Simazine were investigated under different atmospheres (air, H_2 , CO_2), and under various nutritional conditions (presence or absence) of nitrate and/or amino acids and vitamins. On the basis of cultural differences observed among the 18 experimental strains, solid media and cultural techniques were developed for enumeration purposes to study effects of pesticides on the corresponding cultural groups of bacteria in natural soil and rhizosphere populations. (E-fg) Michigan Agr. Exp. Sta.

1-A

Control of Drosophila Egg Laying. Synergized pyrethrum dust may be utilized for post-harvest Drosophila suppression in bin boxes. Experimentation with Vapona indicates that spraying or dipping the container with 5 percent Vapona solution gives residual protection against egg laying and minimizes residue and flavor differences due to the treatment. Ten amino acids and glucosamine were identified in the eggshell adhesive of Drosophila melanogaster confirming the histochemical mucoprotein classification of the adhesive. (E-fg) New Jersey Agr. Exp. Sta.

1-A

Pesticide Pollution of Farmstead Water Supplies. Work on this project was initiated in 1965 to develop information on means by which pesticides reach farmstead water supplies, means for preventing entry and means for dealing effectively with those that do enter. Laboratory methods were studied to determine best procedures to use for the particular requirements of this work. An experimental water system was constructed for use in studying means of pesticide removal. Activated charcoal filters have been constructed and are undergoing preliminary tests. A contaminated well discovered in Southeast Georgia is now being observed. Preliminary findings indicate that a period of continuous pumping does not lower the pesticide level in the water. (I) Watkinsville, Georgia.

1-A

Pesticide Pollution of Farmstead Water Supplies. Limited preliminary work on pesticide removal indicates that active carbon filters show promise as a practical means of removing some types of pesticides from farm water supplies. Work was initiated to develop information on means by which pesticides reach farmstead water supplies, means for preventing entry and means for dealing effectively with those that do enter. Regular examination, sampling and analysis of 48 farmstead water supply systems in two Maryland counties show that 5 of the 24 in the Hagerstown Valley of Washington County (limestone area) have confirmed low-level concentrations of chlorinated hydrocarbon pesticides--all less than one part per billion. Only one well of the 24 sampled in Wicomico County, on the coastal plain, shows confirmed pesticide content--0.2 parts per billion. (I) Beltsville, Maryland. 1-A

Fungicidal Materials in Cellular Metabolism. Time-course studies of pH dependent hydrolysis of cycloheximide oxime and cycloheximide semicarbazone showed that these derivatives attained nearly the same potency as the parent compound, cycloheximide, after 24 hours hydrolysis. Studies of the reaction of Phaltan with fungal cells revealed that the imide portion of the molecule does not enter the cells, but that a portion of the sulfur does. Some of the sulfur can be extracted from the cells with ethanol but some remains bound to proteins. Further aspects of the fate of the sulfur from Phaltan in cells were studied. Studies were made on the reaction of the fungicide tetrachloroisophthalonitrile with biological thiol compounds. One derivative has been isolated and will be characterized. (E-fg) Maryland Agr. Exp. Sta. 1-B

The Effect of the Physical Nature of Residue Deposits on Their Biological Efficiency. The gas-liquid chromatographic (GLC) procedure using electron capture detection allowed determination of less than 0.01 ug of captan. The method involved the extraction of leaf discs with benzene. The above captan residue could be detected on as little as 1 cm² of leaf tissue. Analyses of single 0.2 cm² leaf discs with this procedure have shown that up to five-fold differences in amounts of captan residue occur in adjacent discs of the same leaf. This suggests that infection and subsequent leaf lesions may result through such voids in the residue covering otherwise well protected leaves. These voids appeared to be an effect of drying, for they occurred whether the leaf was sprayed to run-off with dilute sprays or sprayed lightly, but uniformly, with mists of highly concentrated sprays. Simulated rain of various amounts did not appear to redistribute the residue to an appreciable extent. (E-fg) Wisconsin Agr. Exp. Sta. 1-B

Herbicides Cause Both Suppressive and Stimulative Effects on Soil Microorganisms. Mycelial production of Fusarium oxysporum f. vasinfectum was significantly reduced by 40 or 80 ppm of atrazine in liquid cultures. Utilization of glucose, NO₃N, and phosphorus was decreased. In soil, on the other

hand, production of CO₂ was higher where the herbicide was added. Similar growth studies were continued with other organisms including the effects of atrazine on Sclerotium rolfsii and Trichoderma viride, paraquat on S. rolfsii, trifluralin and EPTC on S. rolfsii and F. oxysporum f. vasinfectum, and the effects of several herbicides on Rhizoctonia solani. The significance of the effects of herbicides on plant disease incidence is still to be determined.

(E) Auburn University, Alabama.

1-B

Interactions of Pesticides. In current pest control programs, herbicides, insecticides, fungicides, nematocides, and other pesticides are being used individually and in combination to control numerous plant pests. The number of possible interactions occurring from combinations of two or more pesticides in soil is nearly infinite. Several pesticide combinations reduce plant growth to a greater degree than expected from the effect of the individual pesticide. For example, the herbicide diuron and the insecticides disulfoton (Di-Syston) or phorate are not phytotoxic to certain crop plants at recommended rates. A combination diuron or either insecticide, however, results in a toxic interaction which reduces plant growth. More research is needed to survey the interaction effects prior to field application to avoid widespread losses. (I) Beltsville, Maryland.

1-B & C

Absorption, Metabolism and Degradation of Residues of Two Systemic Insecticides. The plant metabolites of two new systemic insecticides (Temik and Niagara 10242) have been studied. Temik in whole plants or in isolated leaves is quickly metabolized to the corresponding Temik sulfoxide and more slowly to Temik sulfone. The persistence of Temik sulfoxide is demonstrated by its presence in cotton leaves 56 days after treatment of the plant. Niagara 10242 initially forms the 3-OH derivative and this is converted slowly to the 3-Keto compound in which the aromatic ring is further hydroxylated. The water soluble end products of metabolism appear to be glucosidic conjugates or 10242 phenols. Both the 3-hydroxy and 3-Keto derivatives are active anticholinesterases and retain some insecticidal activity indicating that the long-lived systemic activity of 10242 may result from its conversion to other active compounds. (E-fg) California Agr. Exp. Sta.

1-C

Leaching of Parathion. The movement of parathion by water in 10 Texas soils was found to be related to both clay and organic matter content. No simple relationship exists, however. Calculations of the amount of water required to move parathion five feet deep in soils showed that in sandy soils about 200 inches were required and in clay soils up to 1700 inches. These results, though approximate, suggest parathion movement through soils to ground water is not likely to happen, regardless of soil type. (E-fg) Texas Agr. Exp. Sta.

1-C

Soil Profile Distribution of Foliage Applied Chlorinated Insecticides. The 1966 distribution of nine chlorinated insecticides in the soil profile was determined in plots which had received 65 or 130 pounds per acre foliage applications of the insecticides during 1951, 1952, and 1953 growing seasons. Residues of purified aldrin (as dieldrin), and technical aldrin (as dieldrin), dieldrin, isodrin (plus endrin), endrin, heptachlor (plus heptachlor epoxide), chlorcane, BHC, toxaphene, and Dilan were found throughout the 38 cm. soil profile. The percentage of total insecticide residues found in the upper 9 inches of soil, the tilled portion, ranged from 63 to 90 percent. The greatest amounts of insecticide residues were found between the 3 to 9 inch depths. Lesser amounts of residues were found in the surface 3 inches, and the least below the 9 inch depth. The order of decreasing mobility of the insecticide downward were: BHC, isodrin, heptachlor, endrin, toxaphene, dieldrin, aldrin, Dilan, and chlordane. (I) Beltsville, Maryland. 1-C

Adsorption of Dieldrin by Clays. Solubility curves for dieldrin and heptachlor epoxide in pure water show an aging period of 4-5 days for dieldrin and 10 days for heptachlor epoxide, resulting in true solubilities of 0.185 ppm and 0.35 ppm for dieldrin and heptachlor epoxide, respectively. Adsorption studies involving various clays showed that these chemicals are taken up more strongly by illite than any other clay; halloysite was the weakest adsorber. A single treatment with Wisconsin till clay removed 97.8 percent of dieldrin from dieldrin-saturated water; a second treatment removed 99.95 percent of the residue leaving only .054 ppb dieldrin in the water. (E-fg) Illinois Agr. Exp. Sta. 1-C

Metabolism of Lindane by House Flies. Susceptible and resistant house flies metabolize lindane to PCCH and 2 previously undetected organic-soluble compounds (A and B). Since PCCH appears to be an initial product, and it is converted to B but not A, two separate metabolic pathways may exist. Identification of these unknowns will aid in determining the actual pathway(s). (E-fg) New Jersey Agr. Exp. Sta. 1-C

Organisms Utilizing Insecticides as Carbon Source. A number of probable utilizers were isolated by enrichment. Warburg respirometer studies checked each isolate and several were judged to oxidize Thimet, Diazinon, and Bayer 2514, though slowly. These isolates also checked by cholinesterase inhibition studies. Those tested to date were not effective, activity declined at about same rate as controls. (E-fg) North Dakota Agr. Exp. Sta. 1-C

Adsorption of Insecticides by Lake Sediments. Adsorption of lindane and malathion were determined on various lake sediments. Lindane adsorption increased as the solution concentration of the sediment was increased. Amounts of adsorption were related to the organic matter content of the sediments, although the clay size mineral particles also were important adsorption

sites. Removal of iron oxides from the minerals greatly increased their adsorptive capacity. Malathion adsorption followed the same general adsorption patterns although the amounts of adsorption were less. (E-fg) Wisconsin Agr. Exp. Sta. 1-C

Tests of Safety for Viral Insect Pathogens. White mouse and guinea pig tests involving intraperitoneal, intravenous, intracerebral and subdermal injections of specific insect viruses proposed for insect control have been carried out. The viruses were from the five important pest species: Heliothis zea, Trichoplusia ni, Spodoptera frugiperda, Spodoptera exigua, and Estigmene acrea. These tests were supported by inhalation and feeding tests in white mice and guinea pigs. The results proved conclusively that these insect viruses are harmless for these animals. Carefully controlled human feeding tests were also carried out using the specific virus for H. zea without any adverse effects to the human volunteers. (I) Beltsville, Maryland. 1-C

Long Term Persistence of Chlorinated Hydrocarbon in Soils. The persistence of seven chlorinated hydrocarbon insecticides applied to soil in 1949 or 1951 has been determined. The percent of insecticide remaining in soil after 14 years was: Aldrin (purified) - 30 percent; Aldrin (nonpurified) - 50 percent; Dieldrin - 35 percent; Chlordane - 40 percent; Endrin - 40 percent; Heptachlor - 12 percent; Toxaphene - 50 percent or more. The percent of DDT remaining in soil after 17 years was 50 percent for two loam soils and 63 percent for a sandy loam soil. Aldrin, dieldrin, chlordane, endrin, heptachlor, and toxaphene were applied to a Congaree loam soil in 1951 at rates of 0, 50, or 100, and 200 pounds per acre. The DDT was applied to a Chester loam, Evesboro loam, and Sassafra sandy loam in 1949 at rates of 0, 25, 100, 400, and 1,000 pounds per acre. The amount of DDT remaining in soil after 17 years was affected by rate. A greater percentage of DDT persisted in soil at the higher rates than at the lower rates. (I) Beltsville, Maryland. 1-C

Effect of Tranquilizing Agents and Other Drugs on Certain Mature and Immature Insect Species. Twenty-eight additional compounds were screened, including anti-fertility materials, anti-tumor drugs, anti-metabolites and sterols. Study compounds were extensively tested using the house fly, Mexican bean beetle, German roach, and the tobacco hornworm as test insects. The mode of action for 5 promising materials were determined. The effects of these anti-tumor drugs and reserpine on the gonads of the house fly were determined. Several drugs and combinations of drugs were found to act as oviposition inhibitors, sterilants, or otherwise interfered with normal reproductive activity. Preliminary tests with 2 anti-metabolites indicated a reduction in sperm production in the male house fly and an inhibition of egg production in the female. (E-fg) South Carolina Agr. Exp. Sta. 1-C

The Genetics of Resistance in the German Cockroach. During the past year work on formal genetics has included an increasing number of linkage tests. This was possible because of the current availability of 37 visible mutants, of which 23 have known inheritance patterns. Several new markers have been placed in linkage group 3, and Black body (Bl) has been established as a marker for a sixth linkage group. In addition, Curly wing (Cu) has shown a pattern of independent inheritance with markers from autosomal groups 2-5. A disturbance of map distances has been detected in group 3, but the order of the eye color genes in this group appears to be ru - ro - r. (E-fg) Virginia Agr. Exp. Sta.
1-C

Microorganisms Metabolize Malathion. Malathion was found to be metabolized quickly by a soil fungus, Trichoderma viride, and a bacterium, Pseudomonas sp., which were originally found in soils from northern Ohio that had been sprayed heavily with insecticides. Results of a survey of the breakdown capabilities of 16 variants of T. viride revealed that certain colonies from this species had a very marked ability to breakdown malathion through the action of a carboxylesterase(s). The enzymes can be made soluble by preparing the acetone powder suspension. (E-fg) Wisconsin Agr. Exp. Sta.
1-C

Antioxidant Properties of Pesticides. In model systems several organophosphate insecticides (malathion, trithion, parathion, ethion, diaznon) have been shown to decrease the rate of ascorbic acid oxidation. The antioxidant activity of the pesticides studies was proportional to the concentration when pesticides were added between 0 and 10 ppm; however, above 10 ppm of pesticide little (if any) increase the antioxidant activity was noted. In some cases, the decline in rate of reducing power of the insecticide at higher concentrations is undoubtedly due to the lack of solubility in the aqueous model system. The organophosphates had antioxidant activity at various pH values for the model systems. Neither alkaline hydrolysis of the organophosphates nor conversion of the sulfonated pesticides to their oxygen analog markedly reduced their antioxidant activity. The lipid antioxidant activity of the organophosphate was investigated using an artificial fat system. The organophosphates had pronounced lipid antioxidant activity. (E-fg) Wisconsin Agr. Exp. Sta.
1-C

Effect of Pesticides Upon Honey Bees. Replicate small cage tests with bees exposed to dried insecticides on filter paper showed approximate median lethal dosages after 72 hours of 10 micrograms per bee for DDT, 4.8 for malathion, and 0.4 for dieldrin, and 0.16 for parathion. (I) Laramie, Wyoming.
1-C

Conversion of DDT to DDD by Microorganisms. One of the important conversion reactions of DDT in soils involves the formation of DDD. Recently, soil microorganisms have been isolated and identified which are known to carry out this transformation. Detailed studies have been initiated to determine the exact route by which this transformation takes place. Using "heavy" DDT (DDT with a deuterium atom) scientists have been able to show, by taking very precise molecular weights of both DDT and its product DDD, that the reaction must proceed by direct reduction of DDT and not the intermediate formation of DDD and then subsequent reduction. A more thorough understanding of the reactions by which microorganisms transform DDT may open important avenues of research eventually leading to methods of decreasing residues of the use of soil microorganisms. (I) Beltsville, Maryland. 1-C

Insecticide Susceptibility of the Alfalfa Leaf-Cutting Bee, Megachile Rotundata. Exposure of the alfalfa leaf-cutting bees in both greenhouse and field cages to alfalfa and Phacelia sprayed with various insecticides demonstrated sufficient larval loss to indicate that at least some mortality occurs from sprayed alfalfa leaves used in nesting. Of the insecticides tested, azinphosmethyl was the most toxic to the larvae when sprayed on the alfalfa leaves and carbaryl was the safest. (I) Logan, Utah. 1-C

Influence of Soil Organics on Insecticide Adsorption and Reaction. In studies designed to determine the extent to which insecticides and their transformation products are adsorbed or react to soil organic constituents, results showed that the volatilization of lindane and DDT was modified by organic colloids. Recoveries of these insecticides were considerably greater when volatilization occurred in the presence of organic colloids. Considerable amounts of DDT appear to be strongly fixed by organic colloids. (I) Fort Collins, Colorado. 1-C

Movement of Pesticides from Agricultural Lands. A study was initiated to determine the magnitude and mechanisms by which dieldrin is transported from agricultural lands into surface and subsurface waters. Runoff from a watershed receiving 5 pounds per acre of dieldrin contained 3,000 p.p.t. as compared with 40 p.p.t. from the untreated watershed. Rainfall samples collected in the area contained dieldrin concentrations of more than 300 p.p.t. Concentrations varied during the season with the highest amount occurring in June. (I) Coshocton, Ohio. 1-C

Decomposition of Pesticides. Many organic pesticides are decomposed by sunlight on the soil surface. Photolysis of amiben under reducing conditions (NaHSO_3) gave rise to a compound which was subsequently acetylated and methylated to prevent decomposition. Infrared spectra and elemental analysis suggest that this compound may be methyl 3-acetamido-2-chlorobenzoate. Amitrole (3-amino-1,2,4-triazole) decomposition in soils appears to be

primarily a chemical process. Degradation of amitrole occurred in azide- and ethylene oxide-sterilized and nonsterilized soils but not in autoclaved soils. Only slight degradation occurred in autoclaved soil reinoculated with mixed cultures of soil microorganisms isolated from soil in which amitrole had been rapidly degraded. Conversion of DDT [1, 1, 1-trichloro-2, 2-bis(p-chlorophenyl)ethans] proceeds by direct reductive dechlorination to DDD [1, 1-dichloro-2, 2-bis(p-chlorophenyl)ethane] without the intermediate formation of DDE [1, 1-dichloro-2, 2-bis(p-chlorophenyl)=ethylene] in still cultures of Aerobacter aerogenes. (I) Beltsville, Maryland. 1-C & D

Toxicology of Ethylene Dibromide (EDB). A five-year study in Israel produced extensive, valuable information. Many of the results have already been published in 10 articles in scientific journals. At least 4 more will follow. Areas of hazard in the use of EDB as a fumigant for grain, food, and animal feed are delimited. Conditions for safe use have been defined. Residue information was developed not only for EDB but for other liquid grain fumigant components used in combination with EDB: Carbon tetrachloride, carbon disulfide, chloroform, and trichloroethylene. (P.L. 480) Hebrew University, Israel. 1-C

Oxidative Detoxication Enzymes. Larvae and adults of Trogoderma parabale have equal capacity to epoxidize heptachlor. The loss of heptachlor from larvae and adults of the Indian-meal moth, cadelle, and T. parabale is much greater than can be accounted for by heptachlor epoxide production. The rapidly decreasing amounts of heptachlor that can be recovered from treated insects can be accounted for by loss from their bodies to the air and the walls of the holding vials. (E) Iowa State University. 1-C

Residue Analyses in Research Program. During the reporting period 4, 724 residue analyses were made in support of the research program of stored-product insects. An additional 746 analyses were conducted to determine bromide, chloride, and phosphine fumigant residues in wheat, milling fractions, dough, bread, and rolls to learn the effects of repeated fumigation of stored wheat on quality and nutritional factors. This is a cooperative study with the Human Nutrition Research Division. Some time was also spent on improving and developing analytical procedures. (I) Savannah, Georgia. 1-C

Conversion of DDT to DDD in an Aerobic Soil. Sterile and nonsterile soil samples were incubated anaerobically, and another set was incubated aerobically. After predetermined periods of incubation, the samples were extracted and the extracts analyzed for DDT and decomposition products. Under anaerobic soil systems, DDT was converted to DDD (TDE) by microorganisms. Amending the soil with 1 percent alfalfa increased the rate of conversion.

After 6 months of aerobic incubation, 75 percent of the added DDT was recovered in both the sterile and nonsterile soils. These data suggest that a soil polluted with DDT can be decontaminated by microorganisms under anaerobic conditions. (I) Fort Collins, Colorado. 1-C

Movement and Persistence of DDT and Lindane in Soil Columns. Columns of four soils were used to determine the amount of downward movement and persistence of DDT and lindane. Water was added at total depths of 12.7 and 25.4 cm. to separate 10-cm.-diameter leaching columns. Movement of lindane was influenced by soil texture and amount of water applied. DDT remained in the 0 to 3 cm.-layers of all soils regardless of the amount of water applied. Pesticide amended soils subjected to wetting and drying cycles lost more lindane than DDT. (I) Fort Collins, Colorado. 1-C

Influence of Soil Properties on Pesticide Decomposition. The influence of soil acidity and type of clay on the adsorption of herbicides and insecticides was studied in the laboratory. Results showed that soil acidity is the principal soil factor governing the adsorption of herbicides. Adsorption on clays was related to the activity of the clay. Some chlorinated hydrocarbon insecticides undergo rapid catalytic decomposition when mixed with the soil. Heptachlor decomposed very rapidly on oven-dry soil in the laboratory. (I) Beltsville, Maryland. 1-C & D

Phytotoxic Interactions of Pesticides. Phytotoxic interactions result from some pesticide combinations of herbicides and insecticides in soils. A combination of herbicides diuron or dalapon with insecticides disulfoton, phorate or carbaryl produced synergistic phytotoxic effects. Corn and cotton were more tolerant, and oats more susceptible to the combinations. No interactions were noted when insecticides DDT, endrin and heptachlor were individually combined with either diuron or dalapon. Combinations of methylcarbamate insecticides with phenylcarbamate herbicides generally increased the soil persistence of the herbicides. Detailed metabolic studies show that the methylcarbamates strongly inhibit the phenylcarbamate cleaving enzyme. (E) North Carolina Agr. Exp. Sta. 1-C & D

Extreme Toxicity of Picloram in Some Plants. Picloram (4-amino-3,4,6-trichloropicolinic acid) is among the most toxic, persistent, and mobile of all herbicides. One of the main differences between picloram and other herbicides may be the extremely low levels of picloram required to injure some plants. In a pot experiment involving three soils, picloram at 0.2 ppm (0.4 lb/A) or above resulted in no soybean growth 12 months after application. It took more than 5 ppm (10 lb/A) monuron herbicide to accomplish the same residual toxic effects. In a preliminary experiment, 0.01 ppm (0.02 lb/A) of picloram in two soils reduced fresh weights of soybeans 38 and 70 percent,

respectively. In a later experiment with one soil, picloram reduced soybean fresh weights 37 percent at 0.001 ppm (0.002 lb/A). Picloram initial and residual phytotoxicity to barley was much less and corresponded to that of monuron. (I) Beltsville, Maryland. 1-D

Methods for Microdetermination of the S-Triazine Herbicides. A gas chromatographic method has been developed for the quantitative determination of residues of atrazine and simazine in corn, soil and water. An improved version of the alkali-flame detector gives minimum detectable limits at the picogram level. (E) University of Missouri. 1-D

Amiben Metabolism in Crop Plants. Formation of the N-glucoside metabolite of 3-amino-2,5-dichlorobenzoic acid (amiben) by treated plants under controlled variables of environment has been studied. There was a greater absorption of amiben- C^{14} by roots of cucumber and soybean plants treated at 90° F. than at 70° F., but there were no detectable differences in the rate of extent of amiben N-glucosylamine formation at different temperatures or humidity levels. The resistant soybean plants converted 98 percent of the absorbed amiben to its glucoside out of 95 percent of the absorbed herbicide. However, barley an intermediately sensitive plant converted only 45 percent to the glucoside. A high degree of stability of the amiben glucoside was noted in soybean roots. (I) Fargo, North Dakota. 1-D

Herbicide Residues in Water and Soils of Canals and Reservoirs. In California, 99 percent of the mono-N,N-dimethylamine salt of endothall applied at concentrations of 0.5, 0.75, and 3.0 ppmw in irrigation canals during periods of 12, 12, and 3 hours, respectively, persisted in the water for 6 miles in all three canals. In one long canal 60 percent of the chemical remained in the water 16 miles below the point of introduction. Diquat applied at 14.5 ppmw in a canal 3.5 miles long for 40 min. had dissipated to a maximum concentration of 0.17 ppmw at the end of the canal. Commercial bantonite at 15 lb/A removed more than 50 percent of the diquat residue in farm reservoirs and was more effective than activated charcoal at that rate. Agitating the bottom soil with the prop wash on an outboard motor in a shallow warm water reservoir treated with diquat at 1.0 ppmw removed all of the remaining residue from the water. (I) Davis, California. 1-D

Urea Herbicide Degradation and Metabolism. A leaf disc technique has been used to measure simultaneously the transient or irreversible inhibition of photosynthesis and the metabolism of urea herbicides. Leaf tissue which is able to dechlorinate and further degrade urea herbicides recovers photosynthetic capacity. When dechlorination is prevented by simultaneous treatment with certain carbamate insecticides, incomplete recovery from photosynthetic inhibition may result. (I) Fargo, North Dakota. 1-D

The Effects of Herbicides Upon Mitorin Can Be Determined in vivo Immediately by Both Quantitative and Qualitative Methods. Time-lapse cinematographic methods with phase contrast microscopy has been used to record the action of herbicides. Changes induced by herbicides in the structure of the mitotic spindle have been determined with a sensitive rectified polarizing microscope with strain-free optical components. (E) Dartmouth College. 1-D

Structural Changes Induced in Plants by Herbicides. From a gross morphological view, picloram acted much like 2, 4-D. With higher concentration of picloram (7.2 mg per plant) the stems began to swell and bend and the treated leaves began to shrivel within two hours of treatment. With lower concentration apical growth was retarded and flowering delayed. The vascular cambium and its initials remained meristematic when affected by picloram. The most obvious external effect of triflurolin on the primary root was an increase in the amount of radial expansion near the root tip. Although triflurolin disrupted the mitotic process, no one type of mitotic figure prevailed. Mitotic activity was not affected in all the cells. The pericycle and portions of the endodermis were the only tissues that developed abnormally with rates of triflurolin that inhibit lateral root emergence without interfering with the development of the primary root. (E) Davis, California. 1-D

Degradation of Phenylurea Herbicides in Plants. A rapid technique to determine the inherent ability of leaf tissue of different plant species to degrade the substituted phenylurea herbicides has been developed. Assay of the recovery by treated leaf discs of photosynthesis that was inhibited by the herbicides correlated very well with the breakdown of the chemical in those species investigated. The same technique was employed to study interactions of carbamate insecticides with the phenylurea herbicides in cotton plants. When applied simultaneously, certain carbamates prevent the plant from degrading the herbicide and thus present the possibility that use of the insecticide could result in crop injury by an herbicide that is otherwise non-toxic. (I) Fargo, North Dakota. 1-D

Persistence of Copper Sulfate in Irrigation Water and Irrigated Soils. The fate of copper sulfate applied at 1 pound per cubic foot per second (cfs) for control of algae in a canal carrying 411 cfs of water was determined. The concentrations in water were 1.61, 0.36, 0.23, and 0.038 ppmw at sampling points 0.6, 6.0, 11.5, and 23.5 miles, respectively, below the point of introducing the copper sulfate. The percentages of original copper sulfate being carried by suspended sediment (biota and inorganic) were 8.2, 15.2, 16.4, and 3.6 at the same sampling stations. At the last sampling station 23.2 miles below point of introduction, only 5 percent of the original copper sulfate was in the water and 3.6 percent was in suspended sediments. Bottom soil in the canal which had been treated repeatedly for control of algae for

many years had copper concentrations of 3 to 8 ppmw. Virgin soils (never irrigated) in the area contained 0.75 to 0.85 ppmw of copper sulfate. (E) Battelle Memorial Institute - Northwest.

1-D

Persistence of Herbicides in Soil. Depth of placement of herbicides affected their persistence in soils. Samples of atrazine and fenac were placed at 3, 9, and 15 inches in soils at 10 locations in the United States. After a growing season (4-5 months) samples were retrieved and returned to Beltsville for analysis. Two general conclusions were noted: First, atrazine and fenac tended to persist longer at the lower depths in soils and second, both herbicides at all depths seemed to persist longer in the northern half of the United States. For example, after 5 months residual atrazine at 3, 9, and 15 inches in Minnesota was 20, 27, and 36 percent of that applied, in contrast to 1, 2, and 4 percent remaining at the same three depths in Puerto Rico. In the case of fenac in Minnesota, 23, 33, and 37 percent remained at 3, 9, and 15 inches, respectively, while 6, 7, and 13 percent remained in Puerto Rico at the same depths. (I) Beltsville, Maryland.

1-D

Persistence of Acrolein in Irrigation Water and Effects on Crops. Acrolein was applied to soybeans, sugarbeets, and sweet corn in irrigation water at 0.1, 15, and 60 ppmw in 2 acre-inches of water by furrow and overhead sprinkler methods when the crops were in an early fruiting stage. Sixty to 90 percent of the acrolein was volatilized into the atmosphere during sprinkler application before the crops were contacted. Five to 10 percent was lost as the treated water was introduced in furrows. Despite the greater losses of acrolein during sprinkler irrigation crop injury was greater for equivalent concentrations applied to irrigation water than for furrow irrigation. When applied in furrows, temporary injury to foliage occurred to all three crops from 60 ppmw but yields were not reduced. When applied by sprinkling, both 16 and 60 ppm caused light to severe injury to the leaves of soybeans and sugarbeets and 60 ppmw caused moderate injury to corn leaves. Soybean yields were reduced by 60 ppmw but corn fodder or grain yields were not reduced by any concentration. At concentrations used in irrigation water (0.1 ppmw - 15 ppmw) acrolein does not cause significant injury to soybeans, sugarbeets, or sweet corn when applied by either furrow or sprinkler irrigation. (I) Prosser, Washington.

1-D

Research on Possible Mutagenic Effects of Herbicides. Investigations have not indicated that any of more than 100 herbicides assayed should be classified as mutagenic. However, the investigations are not complete and further studies are needed to evaluate completely the significance of the data obtained thus far. Almost all chemicals caused a slight increase in the mutation rate in several test organisms. For example, in one test system, the spontaneous mutation rate is at the relative value of .05 percent while the known mutagen, 5-bromouracil, increases the rate of mutation to 3.0 percent. Some of the

herbicides have caused apparent increases as high as 0.3 percent. It is not believed that these apparent increases are significant. (E) Battelle Memorial Institute, Columbus, Ohio.

1-D

Enzymatic Synthesis of Pesticide Glycosides in Plants. Isolation and identification of the N-glucosyl conjugate of 3-amino-2,5-dichlorobenzoic acid (aminoben) in plants together with studies on the formation of N-glucosylarylamines during the metabolism of 3,4-dichloropropionanilide (propanil) and 2,5-dichloro-3-nitrobenzoic acid (dinoben) by plants, indicate that the biosynthesis of N-glucosylarylamines may be an important pathway in the metabolism of many herbicides by plants. Other herbicides that may be similarly metabolized to arylamines by plants include isopropyl-N-(3-chlorophenyl) carbamate (CIPC), 4-chloro-2-butynyl-N-(3-chlorophenyl)carbamate (barban), N'-(4-chlorophenoxy)-phenyl-N,N'=dimethylurea, and 3-(4-chlorophenyl)-1,1-dimethylurea (monuron). Studies with infiltrated plant tissue sections demonstrated the enzymatic nature of N-(3-carboxy-2,5-dichlorophenyl)-glucosylamine biosynthesis in plants. A soluble enzyme, UDP glucose:arylamine N-glucosyltransferase, which is capable of this synthesis and appears to be widely distributed in plants, has been purified over tenfold from soybean acetone powders. (I) Beltsville, Maryland.

1-D

Differential Metabolism of Atrazine. At least two pathways of atrazine metabolism in plants have been determined. Both resistant and susceptible plant species can cleave the isopropyl and/or the etheylamino substituents from the heterocyclic ring. Grass species possessing benzoxazinome can hydroxylate the ring. The dealkylated products are less phytotoxic than is the original herbicide, and the hydroxyatrazine is non-phytotoxic. Resistant plant species metabolize atrazine to less toxic or non-toxic residues more rapidly than do susceptible species. Either the dealkylation pathway, the hydroxylation pathway, or a combination of both may be involved for a given species. Relative plant resistance to injury from atrazine depends on the rate and extent of detoxication by these metabolic pathways. (I) Fargo, North Dakota.

1-D

Microbial Degradation of an Arsenical Herbicide. Soil microorganisms are partially responsible for degradation of the organic arsenical herbicide, MSMA (monosodium methane arsenic acid), to the inorganic arsenate, which is less toxic because of its unavailability in soil. Four soil microorganisms, isolated in pure culture, degraded the herbicide to arsenate and carbon dioxide, the only metabolites found. (I) Beltsville, Maryland.

1-D

Microbial Degradation of MSMA in Soil. Soil microorganisms are partially responsible for degradation in soil of the organic, arsenical herbicide, MSMA (monosodium methane arsenic acid), to inorganic arsenate. Comparison of evolved $^{14}\text{CO}_2$ from four sterile and non-sterile soils 60 days after treatment

with MSMA- ^{14}C showed that from 1.7 to 10.0 percent of the MSMA- ^{14}C was degraded in non-sterile soil, as compared to 0.7 percent in steam sterilized control soils. Four soil microorganisms, isolated in pure culture, degraded from 3 to 20 percent of the MSMA- ^{14}C to $^{14}\text{CO}_2$ when grown in liquid culture. Thin-layer chromatography effected the separation of MSMA, inorganic sodium arsenate and inorganic sodium arsenite. Using thin-layer chromatography, soil extracts and microbial pure-culture extracts were spotted and developed. Inorganic arsenate, a metabolite, and parent MSMA were the only compounds found. No arsenite metabolite was detected. These data indicate that soil microorganisms are at least partially responsible for MSMA degradation in soil. (I) Beltsville, Maryland. 1-D

Behavior of Trifluralin in Soil. Retention of trifluralin in soil was greatly decreased when exposed to light as compared to darkness. Increasing soil moisture at time of application, decreased the amount of trifluralin retained. Incorporation of trifluralin in a thin layer of soil greatly increased retention over surface application. Sandy soils retained less than clay soils. Trifluralin exhibited less herbicidal activity in very acid soils than in less acid or neutral soils. It leached more in limed soil than unlimed, but leached less in soil to which organic matter was added. Trifluralin added to soil, saturated with water and incubated, exhibited less herbicidal activity than similar treatment with the soil moisture at field capacity. (E-fg) Georgia Agr. Exp. Sta. 1-D

Mobility of Herbicides in Soil Differ Depending on the Solubility and Soil Type. Studies comparing the mobility of dicamba and atrazine in an anselmo sandy loam and a sharpsburg silty clay loam show that dicamba, the most water soluble of the two chemicals, moves more readily than atrazine. As expected, neither herbicide moves as rapidly in the silty clay loam as in the sandy loam. The similarity between rates of movement of atrazine in the two soils indicate that herbicides which are low in water solubility may still be susceptible to upward movement in the soil, under drying conditions. If the herbicide is deposited on the soil surface it may be lost into the atmosphere due to volatilization. (E-fg) Nebraska Agr. Exp. Sta. 1-D

Adsorption of 2, 4-D on Resins. Adsorption of 2, 4-D on cation exchange resins varied with the exchangeable cation, with adsorption following the order of $\text{H}^+ > \text{Ca}^{2+} > \text{Mg}^{2+} > \text{K}^+ > \text{Na}^+$. Both adsorption and solubility enter into the movement of 2, 4-D, since solubility is in the same order as replaceability. Desorption curves showed only slight differences among the exchangeable cations but were in the reverse order from adsorption. Soil columns gave similar results for H, Ca, and Mg, but dispersion of Na and K soils interfered with determination of sorption curves. (E-fg) New Mexico Agr. Exp. Sta. 1-D

Displacement of Herbicides from Clay Minerals. Adsorbed Diquat and Paraquat are readily displaced from vermiculite by equilibration with a dilute salt solution. Release from montmorillonite is much more difficult. When five symmetry of Al, Ca, K, or Mg was equilibrated with a Diquat or Paraquat saturated vermiculite (total salt concentration 0.005N) from 20 to 75 percent of the organic cation was released. (E-fg) North Carolina Agr. Exp. Sta. 1-D

Organic Matter Content of Soil Influenced Breakdown of Prometryne. Increased organic matter content of the soil appeared to cause more rapid breakdown of prometryne, although there was no direct effect of organic matter on herbicide phytotoxicity. The herbicide was more active at higher pH's. In the field in a heavy clay soil, soil prometryne did not begin to dissipate until 3 months after treatment. In a sandy soil this was true after 2 months. It began to show up in the 6 to 9" soil layer after 3 months. Soil pH appeared not to influence the phytotoxicity of cotoran. However, increasing organic matter reduced phytotoxicity. The addition of organic matter on clay greatly reduced the residual activity of the herbicide. (E-fg) Oklahoma Agr. Exp. Sta. 1-D

Triazines Incorporated in Nucleic Acids. Investigation of pesticides to determine possible mutagenic effects of these compounds on bacteria has shown that s-triazine compounds can be incorporated into the nucleic acids of bacteria. (E-fg) Pennsylvania Agr. Exp. Sta. 1-D

Loss of 2, 4-D in Washoff from Cultivated Fallow Land. Quantitative measurement of 2, 4-D was made in the washoff from cultivated Cecil sand loam soil during simulated rainfall intensities and storm durations of 1, 10, 80 and greater than 100 years. Concentrations of 2, 4-D in washoff were greatest early in the storm and decreased with the duration of the storm. Losses from areas treated with the iso-octyl and butyl ether ester formulations of 2, 4-D were 26 percent as compared with 5 percent from the areas treated with amine salt forms during a 100-year frequency storm. After the rainfall applications, soil bioassays showed that most of the 2, 4-D remained in the surface 3 inches of soil. (I) Watkinsville, Georgia. 1-D

Two Microorganisms Capable of Degrading MCPA were Isolated from Soil. Two microorganisms were isolated from soil which are capable of degrading 2-methyl-4-chlorophenoxyacetic acid (MCPA). The rate of disappearance of MCPA was directly correlated with the rate of chloride release with both microorganisms, but phenol determinations showed that the Arthrobacter produced and then metabolized a phenolic compound, whereas F. peregrinum generated a phenolic metabolite whose concentration increased with time. (E-fg) New York Cornell Agr. Exp. Sta. 1-D

Degradation of Linuron Observed in Plant Tissues. Linuron was degraded in the tops of all species to the demethylated intermediates and the dichloroaniline within one week after exposure to the herbicide in nutrient solution. Little or no evidence for metabolism in the roots was observed. Of the linuron entering the plants, only 50 percent could be accounted for; which strongly suggested the possibility of "bound" herbicide in the tissues. At present, investigations are proceeding on the problem of determining the amount of the bound linuron in plant tissues. (E-fg) New Jersey Agr. Exp. Sta. 1-D

Movement of Triazines in Soils. Adsorption of ametryne and atrazine on both a sandy and a silt loam soil were found to follow the Freundlich adsorption isotherm. For both soils, specific adsorption was greater for ametryne than for atrazine, while the energy of adsorption was greater for atrazine. Movement of herbicides through the soil occurred primarily with the water; no flow of herbicide occurred independently of the water movement. (E-fg) Utah Agr. Exp. Sta. 1-D

Movement and Persistence of Atrazine and Diuron. Determinations of the movement and persistence of atrazine and diuron in field soils at 3 locations show decomposition in place to be the primary mode of loss, with leaching accounting for 10-50 percent of the loss. No differences were found between soils previously treated with atrazine or diuron and soils not treated as to their abilities to inactivate these herbicides. The half-life of atrazine was found to be about 30 days in these soils; that of diuron was 60 days or more. (E-fg) Alabama Agr. Exp. Sta. 1-D

Sorption of Diquat and Paraquat by Clays. Sorption of Diquat and Paraquat by three-layer clays was related to the kind of clay, the structural charge, and the inorganic cation initially present. Sodium, Ca, and Mg-saturated montmorillonite sorbed Diquat and Paraquat up to the CEC. Sorption by Ca and Mg vermiculite was always much less than CEC, and usually slightly less than CEC for Na-saturated clay. Sorption by Ca-vermiculite exceeded that relative strength of the water net was important. With increase in CEC of the vermiculites, percent saturation with Diquat or Paraquat decreased. The studies indicate that vermiculitic soils would probably have a lower relative capacity to sorb these herbicides than would montmorillonitic soils, despite the higher CEC of the clay in the former. (E-fg) North Carolina Agr. Exp. Sta. 1-D

Animals

Analytical Procedure to Determine Metabolism and Fate of Pesticides to Which Livestock Have Been Exposed. Extraction and cleanup methodology are being completed for a triazine herbicide compound to which sheep were exposed. Following single or repeated oral exposures to cattle, a candidate systemic organophosphorous insecticide caused toxicity and residue at various dosage levels. Repeated sampling was accomplished by biopsies or necropsies. (I) Kerrville, Texas. 21-A

Neuromuscular Effects of Carbaryl in Swine. Daily doses of the insecticide carbaryl, at 150- and 300-mg/kg levels, mixed in commercial swine feed caused nervousness, irregular gait, ataxia, prostration, spastic convulsions, and death in experimental animals. The number of daily doses necessary to induce symptoms varied with the doses: 62-63 days at the higher dose, 76-82 days at the lower dose. Pathologic examination of tissues showed that lesions were restricted to the central nervous system and skeletal muscles. The nervous tissue changes occurred generally in the medulla and were indicative of cerebral edema. Muscle changes were similar to those seen in "white muscle disease" and consisted of fiber necrosis with swelling, loss of striations, pallor, and vacuolation. (I) College Station, Texas. 21-A

Evaluation of the Hazard of Some Organic Herbicide Compound Formulations. Utilizing an arbitrary yield of forage and rate of consumption of vegetation sprayed with 29 different compounds, the possibility of adverse effects was postulated for cattle, sheep and chickens. As most such compounds have a range of application rates for different crops or vegetation, these rates were compared with screening trial data as to their toxic effect to the three test species. Although in most cases the more commonly employed rates present no danger, the maximum rates often approach, and sometimes surpass, the hazardous level. (I) Kerrville, Texas. 21-A

Toxicity of Candidate and Proven Insecticide Compound Formulations to Livestock. New data were collected on 46 compounds as to the minimal toxic and most effective dosage levels in young calves, cattle, and sheep. Different formulations, routes or methods of exposure, species, age, and breed were studied in relation to possible adverse effects produced. The depression of the enzymatic whole blood cholinesterase activity is utilized as an important facet of such a determination of the great majority of such compounds. (I) Kerrville, Texas. 21-A

Effects of Carbamates on Reproduction. Small (12.5 and 25 mg/kg) doses of a carbamate insecticide, carbaryl, were administered to sheep by oral capsule. Dosing was started prior to mating and was continued throughout

pregnancy. No untoward effects were noted in any of the 12 ewes or their lambs. Carbaryl, at this dose level, did not affect reproduction, pregnancy, parturition, or normalcy of offspring. (I) College Station, Texas. 21-A

Metabolism and Metabolic Fate of Carbamates - Mobam. Rats given a single oral dose of Mobam-- ^{14}C of 2.0 mg/kg or 13.0 mg/kg had only .82 percent of the 2.0 mg/kg dose and .92 percent of the 13.0 mg/kg dose in the total carcass after three days. At the end of eight days 100 percent of the 2-mg and 92 percent of the 13-mg doses were recovered in the urine and feces. Thus, Mobam is readily excreted by the rat and tissue residues of ^{14}C are low. Similar results were obtained when goats were administered doses of 4.6 mg/kg or 12.5 mg/kg of Mobam. (I) Fargo, North Dakota. 21-A

Use of MCA-600 on Bermuda Grass. Silage from Bermuda grass sprayed with up to four time recommended levels of MCA-600 was fed as the only forage to Jersey cows. No detectable levels of residue appeared in the milk after 28 days of feeding. Silage containing up to 90 ppm of MCA-600 in dry matter had no significant effect on silage intake, milk production, cholinesterase activity, plasma carotene or vitamin A. Bermuda grass pastures sprayed with 1.0 lb/acre of MCA-600 were readily grazed by steers the following day. MCA-600 appears to be a very useful and safe insecticide on the basis of these results. (I) Tifton, Georgia. 21-A

Herbicide Toxicity. Under the general assumptions that animals consume 3 percent of their body weight daily, and that one pound per acre of an applied herbicide formulation provides a dosage level of 7 mg/kg, a number of compounds, when applied at maximum application rates, could prove hazardous to cattle, sheep, and chickens consuming vegetation so treated. These would include a number of 2,4-D, CDAA, monuron, diuron, atrazine, simazine, prometone, 2,3,6-TBA, bromocil, isocil, and polychlorodicyclopentadiene isomer compounds that have been studied in the three species. (I) Kerrville, Texas. 21-A

Effects of Carbamates on Reproduction. Comparisons are being made of the effects of different routes of administration; doses of 150-200 mg/kg of carbaryl are being used in pregnant sheep in both studies. (I) College Station, Texas. 21-A

Neuromuscular Effects of Carbaryl in Swine. Swine, after being intoxicated by carbaryl, are being tested to determine possible differences in nerve impulse conductance and velocity. Possible blockage of neuromuscular junctions by carbaryl is also being tested. (I) College Station, Texas. 21-A

Clinical and Biochemical Tests. Samples of tissues and body fluids from livestock exposed to pesticides were studied and compared with similar

samples from nonexposed livestock. Changes in various enzyme systems, the percentage of fetal hemoglobin in calf red blood cells, and mineral ratios were found as the result of the insecticide or herbicide exposures. Normally, fetal hemoglobin of calf erythrocytes is replaced by the adult form at 8 to 10 weeks of age. Following exposure of a limited number of calves to organophosphate insecticides, fetal hemoglobin and the osmotically more resistant red blood cells tend to disappear more rapidly than those of nonexposed calves. (I) Kerrville, Texas. 21-A

The Hazard of Plant or Field Crop Insecticides. Organophosphorous insecticidal compounds not intended for direct livestock exposure(s), but inadvertently contacted by livestock through consumption of sprayed vegetation or spray drift to pasturage, could result in poisoning. Some compounds are a greater hazard than others. Signs of toxicosis were observed that were distinctive for only one compound. Sheep exhibited a marked organoleptic response to some insecticides, refusing to eat contaminated feed. This response was less marked or absent in cattle. (I) Kerrville, Texas. 21-A

Phenothiazine and Other Possible Synergistic Factors and Their Relationship to Toxicosis. Yearling cattle were sprayed with an insecticide formulation consisting of dioxathion and dichlorovos as the active ingredients. In addition to the potentiation that could result from recognized safe concentrations of the two compounds applied simultaneously, the effects of phenothiazine, Vitamin A, and ascorbic acid (the latter two derived from green pasturage) were studied. No adverse reactions occurred that could be attributed to any combination of factors. Similarly, phenothiazine-lead arsenate anthelmintic used with a minimal toxic concentrated insecticide dip with sheep caused no adverse effects. (I) Kerrville, Texas. 21-A

Effects of Nitrates and Other Nitrogenous Compounds on the Toxicity of Pesticides to Livestock. Experiments with various ammonium salts conducted on sheep show that these salts (chloride, sulfate, or a combination of chloride, sulfate, phosphate, and carbonate) cause disturbances of the central nervous system, extensive breakdown of vascular beds in various parts of the body, severe active congestion of the lungs, lowering of the pH of the blood, hyperglycemia, and hyperkalemia. Respiratory failure ultimately causes death. With these studies as background, current experiments are designed to show the influence of the ammonium ion on the toxicity and detoxication of pesticides. (I) College Station and Kerrville, Texas. 21-A

Absorption and Metabolism of Fenthion Related to Fat Level of Diet. S-35 labeled fenthion was synthesized and was utilized to study the absorption, distribution, activation, breakdown, and elimination of systemic insecticides in animals fed high and low fat containing diets. In both rabbits and rats,

the insecticide was found to be absorbed more rapidly, reach its peak in the blood earlier, and be eliminated more quickly in animals fed restricted diets not fortified with extra lipid. (E-fg) Alabama Agr. Exp. Sta. 21-C

Degradation of Insecticides by the Human Liver. The capability of the human liver of handling various insecticides for the first time for many insecticides has been surveyed in this laboratory, and the results were compared with the rat liver. The results of the survey indicated that the general degradation patterns of the livers from these two different species are very similar. (E-fg) Wisconsin Agr. Exp. Sta. 21-C

Slight Residues Produced in Cattle by Shell SD-8447 Sprays. Emulsion sprays of Shell SD-8447 at 0.125, 0.25, and 0.5 percent used in single treatment sprays resulted in a maximum residue of 0.108 ppm in omental fat 1 week after spraying with 0.5 percent. Saturation sprays with 0.25 percent resulted in residues only in the fat and these were no longer detectable 3 weeks after treatment. (I) Kerrville, Texas. 21-C

ENT-25,682 Produced High Residues in Cattle. A calf given 5 mg/kg of experimental insecticide ENT-25,682 daily for 14 days had 40.4 ppm of the insecticide and 0.73 ppm of its oxygen analog in the omental fat; another calf receiving 10 mg/kg daily had 118.0 and 0.27 ppm, respectively, of the two materials. In another test, 100 mg/kg in a single dose gave 118.0 ppm of the insecticide and 0.27 ppm of its oxygen analog 13 days after treatment and 2.0 and less than 0.005 ppm of the two materials, respectively, 63 days after treatment. It is generally believed that only chlorinated hydrocarbons show such persistence. (I) Kerrville, Texas. 21-C

Barbiturate Stimulates Conversion of Dieldrin. Evidence was obtained that a barbiturate, heptabarbital, stimulates metabolic conversion of dieldrin to polar metabolites. Pretreatment of rats with barbiturates to induce protection from acute dieldrin challenges were partially successful. (E-fg) Utah Agr. Exp. Sta. 21-C

Teratogenic and Toxicologic Effects of Veratrum. During its early vegetative growth stage, Veratrum californicum was sprayed with Tordon and Atrazine. The plants wilted rapidly after spraying and were collected 14 days post spraying. When these plants were fed to livestock, they did not produce any toxicologic or teratogenic effects as did nonsprayed plants. (I) Logan, Utah. 21-D

Effects of DDT on the Central Nervous System. The electrical activity of the cerebellum was affected by DDT and could be noted prior to behavioral changes induced by the pesticide. Cerebellum uptake of DDT was more rapid than in other parts of the brain. Exposure of rats to DDT potentiated the activity of

other convulsant drugs. These are preliminary, exploratory observations and additional work is in progress. (E-fg) California Agr. Exp. Sta. 21-E

Physiological Effect of DDT. Animal productivity was not impaired by DDT in the feed at the levels it is apt to be encountered. DDT did not affect rumen fermentation, EKG and respiratory patterns or blood pressure. (I) Beltsville, Maryland.

22-A

Terpenes Reduce Dieldrin Storage in Animal Tissue. A class of natural compounds (terpenes) were shown to reduce dieldrin storage in animal tissue. Vitamin A deficiency enhanced dieldrin storage. Vitamin A and other nutritional deficiencies (vitamin E or essential fatty acids) may depress insecticide metabolism by affecting the integrity of key lipid structures in the liver cell. (E-fg) Utah Agr. Exp. Sta.

22-C

Metabolism of DDT and DDD. When cows were dosed with crystalline DDT 30 days before calving, the amount and level of DDT and DDE excreted for about 50 days post-partum was closely associated with the level and amount of milk fat secreted. However, the pattern for DDD resembled that of body energy loss. Various levels of dietary fat and concentrate intake had no effect on secretion of DDT and its metabolites into milk. DDD accounted for 80 percent of the total residue in milk with DDT was fed; however, it was less than DDT within five days after DDT feeding stopped. (I) Beltsville, Maryland.

23-A

Uses of Dieldrin Contaminated Hay. Large amounts of dieldrin contaminated forage are produced in those areas having had a long history of dieldrin spraying. An experiment to determine whether this forage could be used safely during a cow's dry period revealed that milk produced following calving was the major pathway for excretion of dieldrin consumed on contaminated forage fed prior to calving. Only 2.5 percent of the dieldrin fed appeared in the feces and essentially none in the urine. Thus, feeding dieldrin contaminated forage during the dry period of cows is not feasible. (E) East Lansing, Michigan.

23-A

Excretion Patterns of Heptachlor. Methods of "flushing out" heptachlor residues from feeding contaminated forage was tested in milk cows. Feeding iodinated casein increased heptachlor excretion, but had such an unfavorable physiological effect on the animal as to preclude its use. Ethoxyquin was unsuccessful in altering the pattern of heptachlor excretion. Addition of vegetable or animal fat increased heptachlor absorption. Cyclic feeding or different energy levels had little effect on overall pattern of heptachlor residue excretions. There appears to be no optimum time during which one can feed contaminated hay, nor any method of feeding to reduce heptachlor absorption. (E) College Park, Maryland.

23-A

Use of Larvicides for Controlling Houseflies. Inclusion of an insecticide in cattle rations which would make the resulting feces toxic to fly larvae is one way of eliminating primary fly breeding places on dairy farms. CoRal at 48 ppm in a complete ration reduced housefly larvae by about 75 percent. Milk produced under this regime contained no detectable residue. Another larvicide (Shell SD 8447) was nearly 100 percent effective at 24-36 ppm of total ration. No residues were detected in the milk. These results are preliminary and implementation depends upon further favorable observations.

(I) Beltsville, Maryland.

23-A

Evaluation of a New Insecticide for Alfalfa Weevil Control. GS 13005 is an unnamed organic phosphate which holds promise for the control of alfalfa weevil. The technical material has been fed to lactating cows at levels corresponding to 30, 15 and 7.5 ppm of the total ration. These treatments have failed to produce observable toxic symptoms, nor have there been detectable levels of the material in the milk produced. Expected crop residue levels would result in less than 1.0 ppm in forage. (E) Blacksburg, Virginia.

23-A

Blood and Milk Levels of DDT. The blood from dairy cows fed DDT has been analyzed for DDT, DDE and DDD and there is no correlation between the blood levels of these compounds to that found in the milk produced by these animals. From these results it does not appear that the blood level of DDT and its metabolites can be used to indicate that low levels of DDT, DDE and DDD will be excreted in the milk. (E-fg) Idaho Agr. Exp. Sta.

23-C

Pesticide Excretion in Milk by Dairy Cows. Hay containing heptachlor epoxide has been fed to mature cows during a part of their dry period to determine if later excretion in milk occurs. Nearly all of the pesticide was retained by the cows and then eliminated in milk fat during the next lactation period. Milk fat appeared to be the only significant route of excretion. (E-fg) Maryland Agr. Exp. Sta.

23-C

Acceleration of DDT Removal from Cows. Scientists at New Mexico and Arizona are evaluating methods which will accelerate the removal of stored DDT and its metabolites from lactating cows. The feeding of thyroprotein increased the rate of DDT removal in the Arizona study but not in the New Mexico study. In the latter investigation starvation in early lactation significantly increased the rate of DDT removal. (E-fg) Arizona and New Mexico Agr. Exp. Stas.

23-E

Sheep Refuse Demeton Sprayed Forage. Demeton, a plant insecticide, is not a hazard to sheep when sprayed on vegetation at recommended rates because of refusal of sheep to consume such forage. In contrast, the compound offers an extreme hazard to cattle because of their willingness to consume such vegetation, and possibly, to less tolerance. (I) Kerrville, Texas.

26-A

Carbophenothion Poisoning. Carbophenothion as a field crop insecticide ingested by sheep with feed rations results in aberrant signs of poisoning chiefly involving loss of control or positioning of the head. (I) Kerrville, Texas.

26-A

Analysis of Dip and Water Samples to Determine Toxicant Content. The effectiveness of conventional formulated insecticide compounds during intervals of a dipping operation were determined by gas chromatography. Measurements were of percentage-insecticide available for parasite control from that adhering to the wool or hair of previously dipped animals; the greater the "take-out", the less effective the formulation. In a similar area of research, concomitant with a larvicide toxicity trial, a much more effective means of determining the concentration of toxicant in drinking water was used.

(I) Kerrville, Texas.

26-A

Degradation of Vat Emulsions. Emulsifiable concentrates of malathion, Ciodrin (R) and Diazinon (R) were placed in a vat for sheep dipping operations. Samples collected at intervals of dipping as related to number of sheep and periods of time substantiate the relative effectiveness of the different emulsions and the low percentage of degradation occurring from these emulsions.

(I) Kerrville, Texas.

26-A

Metabolism, Accumulation and Excretion of Dieldrin. Dieldrin fed at the rate of 4 mg/kg body weight was lethal to 10 of 12 sheep by the fourth week. The ability of sheep to withstand poisoning appeared to be directly related to the amount of fat in their bones. Results from administration of radiolabeled dieldrin indicate that bile contains dieldrin metabolites and is a pathway of dieldrin excretion. (I) Fargo, North Dakota.

26-A

Genetic Relationship in Haloxon Toxicity. Further confirmation has been obtained showing direct genetic control of plasma A-esterase levels in sheep. The level of plasma A-esterase in turn has been shown to influence susceptibility to chronic toxicity with Haloxon. Seven of eight sheep without plasma A-esterase developed Haloxon poisoning while a similarly treated group of plasma A-esterase positive sheep were unaffected. (E-fg) California Agr. Exp. Sta.

26-E

Field Crops

Seedling Uptake of Chlorinated Insecticides from Soils. Results from seedling experiments indicate that wheat, soybeans, and corn can absorb endrin, dieldrin, heptachlor, and DDT from soils and translocate these insecticides to the aerial portions of the plant. Soybeans, wheat, soybeans, and corn were grown in rotation on several soil types treated with endrin-, dieldrin-, heptachlor-, and DDT- ^{14}C . After 3 weeks growth, based upon ^{14}C content, the following amounts, in ppm, of insecticide were found in seedling shoots grown in soils treated with 0.5 ppm insecticide:

	<u>Soybeans</u>	<u>Wheat</u>	<u>Soybeans</u>	<u>Corn</u>
Endrin	0.024	0.070	0.045	0.067
Dieldrin	0.024	0.059	0.019	0.017
Heptachlor	0.040	0.046	0.150	0.208
DDT	0.005	0.036	0.007	0.003

(I) Beltsville, Maryland.

31-C

The Fate of 4-Benzothienyl-N-Methylcarbamate in Plants. The new insecticide, 4-benzothienyl-N-methylcarbamate, applied to roots of barley and alfalfa is absorbed and partially translocated to the shoots, but when applied to the shoots there is no detectable movement of the chemical to the roots. When applied to the roots, most (86 percent) remains in the roots. About three-fourths of the insecticide or its metabolites retained in the roots are detected in association with the lignin fraction of the roots, and are tightly bound. In treated leaves a much smaller amount of the radioactivity from the labeled insecticide exists in association with lignin but appreciable quantities of water-soluble metabolites occur. At least one of these is an altered form of the chemical that is complexed with a carbohydrate in the plant. Other metabolites are not yet identified. (I) Fargo, North Dakota. 31-C

Charcoal Reduces Phytotoxic Residues of Atrazine in Soil. The herbicide 2-chloro-4-ethylamino-6-isopropylamino-8-triazine (atrazine) when applied to certain soil types as a pre-emergence treatment to control weeds in corn in Wisconsin, causes serious reductions in the yields of oats and alfalfa planted the year after corn harvest. Scientists have attempted to alleviate the residue problem by applying charcoal to these soils. In one series of experiments, atrazine applied at 2 pounds per acre drastically reduced the stand of alfalfa and completely eliminated oats. Incorporation of charcoal in the soil at 400 pounds per acre completely nullified the phytotoxic effects of atrazine residues. Application rates of 200 pounds per acre, however,

did not completely remove the phytotoxic residues since alfalfa still exhibited severe reductions in yield. These field and greenhouse studies show that charcoal may be used under certain conditions for decreasing the effects of phytotoxic soil residues of atrazine. (E) Wisconsin Agr. Exp. Sta. 31-D

Effect of Insecticides on Wheat Quality. In 1963 two diatomaceous earths, two silica aerogels and malathion were applied to 1952 crop year hard winter wheat with moisture content of 10.5-11 percent. Three years after treatment there was no effect on yield of flour, fat content, mixing peak by the farinograph, or absorption. Increase of fat acidity in treated and untreated wheat was greater in the third year than in the previous two. Diastatic activity (maltose) increased in all wheat except that treated with one of the diatomaceous earths. Hot bread from treated and untreated wheat had a stale odor. (I) Beltsville, Maryland. 321-C

Effect of Repeated Fumigation on Wheat Quality. Fumigated wheat is milled and baked in cooperative work between Market Quality and Human Nutrition Research Divisions. Fumigants tested are phosphine, methyl bromide, and a 3:1 mixture of ethylene dichloride and carbon tetrachloride. The fumigants have not affected the quality factors of the wheat or flour in milling tests. There were no significant changes in physical dough tests or in quality characteristics in baking. Hot breads baked from fumigated wheat had a normal odor when taken from the oven and were similar to those baked from untreated wheat. (I) Beltsville, Maryland. 321-C

Atrazine Residues on Oats. A study examining the effects of known amounts of residues on yields of oats and soybeans was continued at Waseca and expanded to Lamberton and Morris. A 1/2 lb/A rate of atrazine reduced oats stands by 42 percent with no significant affect on yields. At 1 lb/A atrazine reduced stands by 63 percent and yields by 25 percent. At 1-1/2 lb/A atrazine reduced oat stands by 76 percent and yields by 42 percent. Considerable necrosis was observed in soybeans but only the highest rate (1 lb/A) reduced stand counts and then only by 10 percent. Residue amounts of atrazine at all 3 locations generally resulted in yield increases averaging about 10 percent. This was attributed to some weed control from the atrazine. (E-fg) Minnesota Agr. Exp. Sta. 323-D

Chemical Control of Rice Blast (*Piricularia oryzae*). Fifteen chemicals were evaluated for control of leaf infection of rice plants by *Piricularia oryzae*. Two chemicals and a combination of them effectively controlled this disease. There were only 15 to 20 percent as many lesions on plants treated with the two chemicals as for untreated plants. As yet, neither of these chemicals is registered for use on rice in the United States. (I) Beaumont, Texas. 324-B

Fate of Propanil in Rice. Propanil is used extensively in rice to control barnyardgrass and other annual weeds. It is absorbed both by roots and shoots of rice. The organic acid side chain portion of the herbicide is predominantly removed by the rice shoots leaving a metabolite, 3,4-dichloroaniline. The organic acid portion is readily metabolized to normal plant products. The aniline is complexed with glucose in the shoots to form an intermediate metabolite which may be redistributed throughout the plant. At least two other metabolites have been detected that also contain 3,4-dichloroaniline, but they are otherwise unidentified. Rigorous extraction procedures increase the amount of substituted aniline recoverable. The anilines extracted have been proved to be 3,4-dichloroaniline, most likely from the metabolism of propanil. All portions of the treated plant contain one or more of the propanil metabolites. (I) Fargo, North Dakota. 324-D

Propanil Metabolite Residues in Rice Grain. Propanil is used extensively to control annual weeds in rice as an early post-emergence treatment. As part of a broader research project concerning the fate of propanil in plant tissues, the accumulation of residues of metabolites containing 3,4-dichloroaniline, an expected product of propanil degradation, was determined in the milled or polished rice (head rice) and in the whole kernels (rough rice). Bluebonnet 50 rice was treated with propanil in 1966 at 4 lb/A in the Stuttgart, Arkansas, experimental plots when the plants were 2 to 5 inches tall (May 23). Treated head rice contained an average of 1.5 ppm (air dry basis) of residue 3,4-dichloroaniline reported as propanil, and untreated head rice contained 0.6 ppm. In rough rice, the samples from treated plants contained 1.8 ppm and the untreated 1.1 ppm. The relatively high untreated figures are believed to be residues derived from propanil to which the plants were inadvertently exposed through the soil or flood water. Samples of grain derived from plots harvested before the introduction of propanil contained no 3,4-dichloroaniline. (I) Stuttgart, Arkansas; and Fargo, North Dakota. 324-D

NIA-10242. No residues of Niagara NIA-10242 or its phenolic hydrolysis product were found in milk of cows fed silage made from corn treated at 0.25, 0.50, or 1.0 pound per acre. Cholinesterase activity of the blood of the animals appeared unaffected. (I) Tifton, Georgia. 326-C

Imidan and Imidoxon. Corn treated with Imidan at 0.25, 0.50 and 1.0 pound per acre showed initial residues of 2.7, 7.1 and 10.9 ppm Imidan and 0.00, 0.01 and 0.02 Imidoxon, respectively. Seven days after treatment residues were 0.09, 0.26 and 0.63 ppm and no Imidoxon was detected. Milk from cows fed 42 days on corn silage to which 19 ppm Imidan was added showed no detectable Imidan or Imidoxon residues. Blood cholinesterase of the animals appeared unaffected. (I) Tifton, Georgia. 326-C

Corn and Johnsongrass Remove Atrazine from Soil. A 3-year study showed that 1 month after atrazine application plots cropped with Johnsongrass or corn had less atrazine remaining than fallow plots but thereafter there were no consistent differences between plots. The top 6-inch soil layer had more atrazine than any lower layer. There was no herbicide build up on heavy clays underlying sandy top soils nor in plots treated for 3 successive years at 16 lb/A. Less than 0.1 percent of C^{14} absorbed as C^{14} -ring-labeled atrazine by corn was collected as $C^{14}O_2$ in a 5-day period following treatment. This confirms earlier findings with a different corn variety, different cultural procedures, and a less sensitive radioassay system. Hydroxyatrazine and two unknown metabolites of atrazine were found in corn. The two unknown metabolites apparently were not derived from hydroxyatrazine. (E-fg) Alabama Agr. Exp. Sta. 326-D

Dursban Residues on Coastal Bermudagrass. Coastal Bermudagrass treated with Dursban at 1.0 pound per acre showed initial residues of 13.2 ppm of Dursban and 0.12 ppm of the oxygen analog. After 21 days residues declined to 0.18 and 0.004 ppm, respectively. (I) Tifton, Georgia. 331-C

Absorption and Fate of DCNA in Plants. Studies of the fate of the fungicide 2,6-dichloro-4-nitroaniline (DCNA, Botran) in soybeans have shown that root tissue of this species is effective in absorbing and retaining residues of the fungicide. Soybeans were grown in nutrient solution to which DCNA was added. Young (20-day-old) greenhouse-grown soybeans in 5.9 ppm DCNA accumulated DCNA to a concentration of 10 ppm in the roots and 18 ppm in the shoots (fresh wt. basis) one day after initiating treatment. The concentration of DCNA decreased with time in both shoots and roots to less than 1 ppm after 7 days. Metabolites of DCNA were detectable immediately in the roots and within 3 days in the shoots, and formed a major portion of the absorbed DCNA within a week. (I) Fargo, North Dakota. 341-B

New Metabolite of DCNA in Soybeans. Research has demonstrated that soybean plants alter the structure of the fungicide 2,6-dichloro-4-nitroaniline (DCNA). Two metabolites were detected in treated root tissue, the major one amounting to approximately 80 to 90 percent of the total detectable metabolites. Comparison of the isolated metabolite with authentic chemical synthesized in this laboratory was accomplished by infrared spectrophotometry and mass spectrometry. The identity of the major metabolite is 4'-amino-3',5'-dichloro-malonanilic acid. This is the first known indication of the occurrence of a complex of a pesticide metabolite with malonic acid in plants. (I) Fargo, North Dakota. 341-B

Absorption and Translocation of Endrin in Plants. This chlorinated hydrocarbon insecticide is readily absorbed by roots of ten crop species and is

translocated throughout vegetative shoots in small amounts. Endrin is much less mobile when applied to leaves of soybean. The insecticide can be recovered from mature beans only after having been applied to immature pods. No metabolites of this insecticide have been recovered from the crops studied. (I) Fargo, North Dakota. 341-C

Uptake of Several Chlorinated Hydrocarbon Insecticides by Soybean Plants.

Soybean uptake of C^{14} -labeled DDT, dieldrin and endrin was measured from two soils. Based on radioactivity, the concentration of these insecticides in the aerial portion of the plants increased with rate. Endrin concentration increased with time. The soybean concentrations of DDT, dieldrin, and endrin or their metabolites were respectively 32, 334, and 309 ppb (parts per billion) from a soil insecticide application of 5 ppm. At 0.5 ppm soil application, the soybean concentrations of DDT, dieldrin, and endrin were 6, 24, and 30 ppb, respectively. Endrin concentrations in soybean shoots were 137, 211, and 462 ppb after 39, 67, and 90 days, respectively. In all cases insecticide concentrations were higher in soybeans taken from Lakeland sandy loam soil than from Hagerstown silty clay loam. (I) Beltsville, Maryland. 341-C

Metabolic Fate of CIPC. Isopropyl N-(3-chlorophenyl)-carbamate (CIPC) is metabolized by soybean seedlings. CIPC labeled with C^{14} in the ring or in the isopropyl side chain, was added to nutrient solution in which soybean seedlings were placed. Presence of C^{14} from ring-labeled CIPC and lack of C^{14} from side-chain labeled CIPC in the shoot tips indicated that the herbicide was metabolized in the roots and that the remaining ring structure was translocated to the shoots. The isopropyl fragment did not translocate to the shoots, and may have been further degraded in the roots. Increase with time in the water-soluble radioactivity from ring-labeled CIPC, coupled with no parallel increases following treatment with chain-labeled CIPC, indicated that the herbicide was cleaved into a water-soluble moiety that contained an aniline structure, as well as into possible conjugates and other degradation products. (I) Fargo, North Dakota. 341-D

Formation of Carbohydrate Complexes of Pesticides and Their Metabolites.

It has been clearly established that the herbicide amiben is not readily degraded by soybean plants. However, it is modified in the plant roots by attachment of a sugar molecule to the nitrogen atom of the herbicide. This method of modification of an herbicide is believed to be important in the metabolism of a number of different pesticides and their metabolites. More than 95 percent of the amiben absorbed by soybean plants exists as the carbohydrate complex with the otherwise intact herbicide. This complex is stable in soybean roots for at least two months under greenhouse conditions. Only traces of amiben and its major metabolite can be found in the stems and leaves of soybeans. (I) Fargo, North Dakota. 341-D

Herbicidal Action Found in Isomers of Pyramin. The herbicide pyramin is used extensively in sugarbeet production. Some injury to the crop, which could not be readily explained, has occurred occasionally from this use. The technical grade of pyramin used in the commercial herbicide preparation contains 80 percent of pyramin and 20 percent of a mixture of impurities which is often largely isopyramin is as herbicidally active as pyramin. It is, therefore, possible that variation in the amount of isopyramin in the technical base could cause a change in the level of the commercially prepared product tolerated by sugarbeets. These data are of vital importance in identifying and eliminating the cause of occasional injury of sugarbeets by formulated pyramin. (I) Beltsville, Maryland.

372-D

Horticultural Crops

Effect of Herbicides on Fruit Sugars and Eating Quality. Apples, blueberries, and peaches grown on soils treated with different herbicides were analyzed for total solids, total and reducing sugars, sucrose, glucose, and fructose. Diuron, simazine, CIPC (isopropyl N(3-chlorophenyl) carbamate) and amitrole were used in the apple orchards; diuron and simazine were used on soils for blueberries and peaches. In only one case did the herbicide treatment significantly affect sugars. The peaches grown on soils treated with simazine at 4 pounds per acre were significantly higher than others in sucrose, 6.8 as compared with an average of 6.3 percent in others. This finding agreed with taste panel results. These peaches scored highest in flavor. Differences between crop years in the amount of sugars in apples and in blueberries were greater than the differences among herbicide treatments. (I) Beltsville, Maryland.

41-D

Effect of Herbicides on Quality of Vegetables. There was no effect of herbicides on tomato color, firmness, and other qualities of Roma tomatoes except acidity was lower in canned tomatoes from plots treated with 5#/A of Diphenamid. In fresh tomatoes the same lot was firmer than fruit from plots treated with 3/4#/A of Trifluralin.

When snap bean plots were treated with DNBP the canned beans were lower in percent seed than the control. Five-sieve beans from plots treated with 3/4# and 1-1/2#/A Trifluralin were lighter in color than the control when frozen. Also, four-sieve beans, canned from DNBP treated plots, were darker in color by CDM \underline{L} value than most other treatments. There was no effect of herbicides on crooks and malformed pods in fresh beans. DNBP injured the plants and lowered yields with each size classification.

In general, there was no effect of treatments on quality measurements of sweet potatoes except by the CDM L value of mashed canned potatoes. Samples from plots treated with Vernolate were darker in color than control, possibly indicating more discoloration. There was no effect of herbicides on grades of fresh potatoes on two varieties. (E-fg) Arkansas Agr. Exp. Sta.

42-A

Removal of DDT Residues from Potatoes During Preparation for Eating.

Commercial washing removed about 25 percent of the DDT. Washing plus lye-peeling removed about 85 percent. Commercial processing reduced the residue to insignificant level. During home preparation procedures, peeling removed approximately 95 percent of the DDT. Potatoes boiled and pressure cooked without peeling showed no significant decrease in residue level. Residue levels were unchanged in potatoes stored at 45° F. for 6 weeks.

(E) National Canners Association.

421-C

Effect of PCNB on Potato Quality. Potatoes grown in PCNB-treated soils were lower in tyrosine content than control potatoes. As a result of the lower tyrosine content, enzymic browning was less in potatoes grown in treated soils than in the control potatoes. There were significant changes in organic acids and amino acids during storage. Changes were greater at 70° F. than at 55° F. Citric acid, alanine, isoleucine, phenylalanine, tyrosine, and valine increased. Aspartic and glutamic acids decreased. (I) Beltsville, Maryland.

421-G

Removal of Malathion Residues from Tomatoes During Preparation for Eating.

Commercial washing operations removed between 83 and 95 percent of the malathion residue. Commercial processing and juicing of peeled tomatoes lowered the residue to less than 1 percent of the initial value. During home preparation, a cold water wash was ineffective in removing residual malathion; peeling removed more than 90 percent. Storage of fresh tomatoes for 10 days resulted in a decrease of about 30 percent in the malathion residues.

(E) National Canners Association.

422-C

Nutrition of the Pea Aphid. Nutritional studies on the pea aphid, Acyrtosiphon pisum, have disclosed that this insect requires a dietary source of both methionine and cysteine, in addition to the other normally essential amino acids. The aphid's requirement for sulfur amino acids was studied in detail, and it was found that the cystathionine metabolic pathway was apparently not present in this species. The cysteine requirement could be partially satisfied by nonamino acids, providing a free sulfhydryl group was present. (E-fg) Wisconsin Agr. Exp. Sta.

425-C

Removal of Carbaryl Residues from Spinach During Preparation for Eating. Almost 90 percent of the carbaryl residue was removed by commercial washing procedures; further processing removed 99 percent of the initial residue. More than 80 percent of the carbaryl residue was removed by home preparative procedures. (E) National Canners Association. 427-C

Removal of DDT Residues from Spinach During Preparation for Eating. Commercial washing operations removed up to 70 percent of the DDT residue depending on the length of the wash; further processing removed approximately 90 percent of the initial DDT residue. During home preparative procedures, washing removed about 30 percent of the DDT residue. After washing, no significant decrease in residue was noted by home cooking; blanching for freezing removed about 53 percent of the initial DDT residue. There was no significant loss of residue during storage at refrigerator temperatures for 15 days. (E) National Canners Association. 427-C

Removal of Parathion Residues from Spinach During Preparation for Eating. Commercial washing procedures removed only 25 percent of the parathion residue; further processing removed another 40 percent of the initial residue. During home preparation, a cold water wash removed about 39 percent of the initial residue; household blanching and cooking were ineffective in removing parathion. Storage for 12 days at refrigerator temperatures produced no change in residue levels. (E) National Canners Association. 427-C

Absorption, Translocation, and Persistence of Radio-Labelled Dimethyl sulfoxide Applied as a Foliar Spray to Peach Trees. Control of peach bacterial spot is enhanced when the solvent dimethyl sulfoxide (DMSO) is added to sprays of the antibiotic oxytetracycline. To learn more about the role played by the solvent, field grown Shippers Late Red peach seedlings were sprayed with a 2 percent solution of sulfur-35 radio-labelled DMSO. Applications were made one to three times at weekly intervals starting 4 weeks before fruit maturity. Sprayed leaves showed greater accumulated radioactivity than fruit. With the second application, both reached a saturation level of radioactivity. Two weeks after the last weekly application 85 percent to 90 percent of the radioactivity had disappeared. The addition of the oxytetracycline to the S-35 sprays did not change the level of radioactivity recovered. Only 1 to 2 percent of the initially deposited S-35, or a metabolite of it, was translocated to unsprayed leaves or fruit. (I) Beltsville, Maryland. 431-B

Technique for Rapid Screening of Pear Seedlings for Fire Blight Resistance. To accelerate the breeding for resistance to fire blight in pears, an artificial inoculation program is being developed for the screening of seedlings. Nearly 6,000 two-year-old seedlings from 69 controlled crosses were inoculated twice in 1967 with a cell suspension of Erwinia amylovora and an abrasive.

Immediately after inoculation the plants were kept for 3 days under plastic tunnels where the atmosphere was held at 100 percent R.H. while the temperature was controlled to a range of 65-85° F. with shading materials above tunnels. Differences in resistance between progenies were observed and percentages of plants in which blight ran more than 15 cm. varied from 0 to 82 percent. The average percentage of blighted plants between all the progenies was 27.5 percent with average blight running 18.8 cm.

(I) Beltsville, Maryland.

435-B

Nematode and Phylloxera Resistant Rootstocks for Grapes in California.

Phylloxera and nematodes are becoming increasingly important problems in grape production in California and this has increased the interest in rootstocks. In 3 different vineyards in 1966, Emperor vines on the new Harmony rootstocks (introduced by USDA) outyielded those on the commonly used 1613 rootstock with no reduction in color or attractiveness of the fruit, such as associated with 1613. In tests with Thompson Seedless in very sandy soils, vines of Harmony outgrew and outyielded those on 1613 rootstock. Selection 91-102 of the Fresno Station was superior to Harmony and 1613. (I) Fresno, California.

451-B

Forests

New Analytical Techniques Developed to Expedite Experiments with Systemic Chemicals. Tetramine has been suggested as a possible systemic chemical for reducing animal damage in trees. Studies with radioactive tetramine showed that important browse plants absorbed the chemical at a much faster rate than tree seedlings. While this particular compound was not successful on trees, the techniques developed in the experiment will greatly expedite subsequent testing of other potential systemics. (I) Olympia, Washington.

5-A

Movements of Systemic Insecticides Within Plant Tissues. Movement of both Bidrin and Thimet were tested on loblolly pine seedlings. The largest amounts of Bidrin were found in the needles and the xylem one day after treatment. Fifteen and thirty days after treatment Bidrin was still largely detected in the needles but the phloem and cambium contained greater amounts than the xylem. This indicates lateral diffusion of the Bidrin from the xylem into the phloem and cambium or a downward translocation of the material from the needles. The results using Thimet under the same experimental conditions were similar. (I) Athens, Georgia.

5-C

Movement of Persistent Insecticides Through the Soil. There has been concern regarding the use of persistent chemicals for prevention of termite attacks because of the possibility of contaminating wells and streams. In seven major soil types, water emulsions of the insecticides were applied to the soil surface at the rate of 1 pint per square foot. After six years over 67 percent of the chemical remained in the top inch of soil, and in most cases less than 1 percent was found 4-3/4 inches below the surface. Furthermore, neither bioassays nor chemical analyses have shown any insecticide present in a spring and a swamp downgrade from large termite control plots established in Mississippi in 1956 and 1958. These two studies indicate that there is no significant insecticide movement through the soils studied, and that there appears to be little danger of contamination of wells and streams by them. (I) Gulfport, Mississippi.

5-C

Formosan Subterranean Termites Attack Living Hardwood Trees. A variety of species of hardwood shade trees in New Orleans have been found infested by the introduced Formosan termite. Chinese elm, ash, oaks and other species have been attacked. Nests occur in the soil and the trunks are hollowed out by the termites whose activities sometimes extend into the limbs. Although decay is sometimes associated with infestation, it is not always apparent. (I) Gulfport, Mississippi.

5-C

Irradiated Wood and Plastic Resist Termites. Untreated lumber of most commercial species is susceptible to termite damage, especially when in contact with the soil. A study involving a combination of wood, plastic and irradiation treatment, revealed after 10 months' exposure to termites in Mississippi that monomers of the plastics methyl methacrylate and methacrylic acidmethyl methacrylate solution impregnated into the wood and irradiated with cobalt 60 made the wood somewhat resistant to termite attack. Further study is necessary to determine whether these treatments will give the long-term protection required of an acceptable wood preservative. (I) Gulfport, Mississippi.

5-C

Movement of DDT and Zectran Through a Forest Soil. DDT at 0.5 and 5.0 pounds per acre and Zectran at 0.1 pounds per acre were applied on the ground above tension lysimeters. The lysimeters were located under 1 inch thick forest floor and under 4 inches of Barneston gravelly sand, both of which were under a 35-year-old Douglas-fir plantation near Seattle, Washington. Leachates collected during the following year were analyzed using benzene extracts of water samples, and benzene extracts of activated carbon columns employed for concentration in the field. Gas chromatographic analysis indicated that very little DDT passed through the forest floor, and even less through the surface soil. Zectran analyses were not yet reliable. Results of the study to date attest to the strong retention of DDT by the forest floor and organic fraction of forest soils. (E) Seattle, Washington.

5-C

TARGET V

TO STUDY ECONOMIC ASPECTS OF PEST CONTROL; SURVEY PESTICIDE USE; DETERMINE THE SUPPLY AND REQUIREMENTS FOR PESTICIDES; AND GIVE ASSISTANCE TO CONTROL AGENCIES AND INDUSTRIES IN EMERGENCIES

Aggregate Economic Implications of Pest Control in Agricultural Production.

The aggregate economic implications of factors related to pesticide use and the economic impact associated with banning specified chemicals will continue to be important parts of the investigations during fiscal year 1968. A cooperative research project is underway with the Agricultural Experiment Station in Missouri to conduct an economic analysis of the productivity of chemical pesticides and other selected resources in agriculture. The factors related to production being investigated in counties included in the 1964 Nationwide Pesticide Survey are land, labor, and the important capital inputs of pesticides, machinery, fertilizer, and buildings. (I) Washington, D. C.; and (E) Missouri Agr. Exp. Sta.

Economic Implications of Pest Control for Selected Crops. Two studies in cooperation with the Agricultural Experiment Stations in Michigan and Nebraska are currently related to corn and soybeans. Survey data will provide the basis for describing patterns of pesticide use, relationships of yield to pesticide use, and differences between users and non-users. Preliminary tabulations for the counties surveyed in Nebraska indicate that almost a half of the corn and sorghum acreage was treated with herbicides, and nearly 60 percent of the corn acres were treated with insecticides or fungicides. (I) and (E) Lincoln, Nebraska; East Lansing, Michigan.

Economics of White Pine Blister Rust Control. A systematic economic and biological evaluation of blister rust control on National Forests in northern Idaho, western Montana, and eastern Washington revealed that blister rust was infecting young western white pine stands at an average rate of three percent per year in spite of best known control efforts. As a result, control was curtailed in these areas because of little chance, economically, to bring the stands through to merchantable size. (I) Missoula, Montana.

Cost of Control of Mesquite on Rangeland. Aerial spraying, chaining and tree dozing were the most common methods of mesquite control in the study area. The average cost per acre of the initial treatment was \$3.00 for aerial spraying and chaining, and \$10.00 for tree dozing. Under current prices the tree dozing method gave a negative rate of returns on investment even with government cost sharing under the Great Plains Conservation Program. The rate of returns for spraying and chaining methods on upland soils with 50 percent cost sharing was 28 percent and 30 percent respectively. However, without cost sharing the rate of return decreased sharply to 8.5 percent for spraying and 13 percent for chaining. The rate of returns for spraying and chaining on bottomland soils was considerably less than the returns for upland. (E-fg) Texas Agr. Exp. Sta.

Pest Control Practices in Marketing Channels. A sample of elevators and feed mills was surveyed to determine pest control practices and costs of these practices. All firms interviewed used USDA approved fumigants. Costs are nominal and vary with length of storage and weather conditions. Greatest problems are associated with receipt of infested grain. (E-fg) Mississippi Agr. Exp. Sta.

Effects of Insect Control Methods on Market Value. Samples of flue-cured tobacco from (a) light trap areas and (b) non-light trap areas were followed from the curing process through sales at the warehouse. Observations were made of tobacco during production, curing and marketing phases and pertinent data recorded throughout the season. Data on quality, quantity and price of the tobacco were recorded from warehouse sales tickets. Marketing data obtained is now being edited, tabulated and analyzed and a report based on the findings is being prepared. (E-fg) South Carolina Agr. Exp. Sta.

Economic Analysis of Water Pollution by Pesticides and Other Agricultural Wastes. Cooperative research continues with Iowa State University. Residue and waste problems are considered in a watershed case study. One objective of the study is to improve current techniques for evaluating economic impacts of pollution. Considerable staff work was devoted to task force activity in the area of environmental quality. (I and E) Ames, Iowa; and Washington, D. C.

Legal Aspects of Water Quality Standards and Their Enforcement Under the Federal Water Pollution Control Act as Related to Agricultural and Rural Resources. This study assesses some of the legal implications of water quality standards on agricultural operations. The problem of agricultural chemicals was considered in addition to agricultural wastes. (I) Denver, Colorado.

Survey of Pesticide Use in Agricultural Production. Tabulations from the 1964 Nationwide Pesticide Survey show that farmers used almost 458 million pounds of technical materials included in commercially formulated products to control crop and livestock pests. In addition they used about 313 million pounds of petroleum primarily as a pesticide. About 90 percent of these materials were used on crops. Several of the technical materials accounted for a large share of the total. Sulfur was the major fungicide material and was concentrated on cotton, fruits, and vegetables. The herbicide most commonly used was 2,4-D which was most often applied to corn and small grain. Toxaphene and DDT were the major insecticides used and over half of them were applied to cotton. The field work for the 1966 Pesticide and General Farms Survey has been completed. Data are currently being edited and tabulations will begin late in 1967. (I) Washington, D. C.

Pesticide Use on Forest Lands. Nationwide use of pesticides for control of forest insects and diseases on Forest Service-managed lands and on cooperative projects were reported and summarized. (I) Washington, D. C.

Pesticide Production and Sales. Both production and sales of synthetic organic pesticides increased at a greater pace in 1966 than even in 1965. The value of production was 26 percent and producers' sales 18 percent above 1965. This upward trend in sales at progressively increasing rates has occurred each year since 1963. Sales were up 59 percent over 1963. (I) Washington, D. C.

Consumption. Domestic disappearance at the manufacturers' level can be calculated for only a few chemicals because so many pesticides are proprietaries. Total U. S. sales of pesticide chemicals in 1966 had a manufacturers' value of around \$800 million. They included (1) sales of 841 million pounds of organic chemicals classed as primarily pesticides; (2) sales of a further probable 250 million pounds of spray oils and fumigant chemicals used mainly for other purposes than pest control; and (3) sales of about 200 million pounds of inorganic arsenicals, sulfur, etc. The proportion of total sales which is exported is hard to estimate. Many pesticide exports contain the active ingredient mixed with dry or liquid diluents and other additives. This processing accounts for an indeterminate part of the export value. Imports of benzenoid and botanical pesticides in 1966 had a value of \$15 million. These categories account for nearly all U. S. pesticide imports--less than 9 percent as much as the value of exports of pesticides. (I) Washington, D. C.

Exports. U. S. pesticide exports in 1966 were valued at \$173,633,000, up a record breaking 30 percent from the previous year. Insecticides comprised 58 percent, herbicides 21 percent, fungicides 13 percent, fumigants 2.6 percent, and rodenticides 0.4 percent. Prominent among insecticide exports

were phosphorus insecticides leading with 19 percent of all 1966 pesticide exports, DDT with 11 percent, and other polychlor insecticides with 12 percent. Canada, Egypt, Mexico, and Colombia led in that order in the value of pesticides received from the United States in 1966. The four leading countries the previous year were Canada, Mexico, Egypt, and Brazil. Sizeable quantities of pesticides continued in 1966 to be shipped from the United States to eastern European countries. The Soviet Union received shipments valued at \$1,294,000, Yugoslavia \$712,000, Hungary \$235,000, Rumania \$111,000, and Czechoslovakia less than \$1,000. U. S. exports of pesticides to South Vietnam in 1966 had a value of \$411,595. The pesticide exported there in largest quantity was, as in 1965, the 75 percent DDT formulation, equivalent to 300,000 pounds actual DDT--much less, however, than the 1,773,000 pounds DDT equivalent shipped in 1965. A considerable variety of phosphorus insecticides, household insecticides, fungicides, and others made up the total for 1966. This did not include military shipments because they are considered domestic. U.S. exports of pesticides during the first half of 1967 had a value of \$105 million. This is at an annual rate appreciably higher even than last year. Although shipments abroad may decline in the second half the total for 1967 should yet be well above that for 1966. (I) Washington, D. C.

Imports. Imports of benzenoid pesticides in 1966 had a value of \$6,252,000, double those the previous year. West Germany and Mexico contributed heavily to the increase. The United Kingdom, West Germany, and Denmark again led as exporters to the United States but their tonnage share of this market slipped to 67 percent from 89 percent in 1965. Imports of the major botanical products (pyrethrum, nicotine, and rotenone) in 1966 had a value of \$8,327,000, up 28 percent from 1965. (I) Washington, D. C.

Carbaryl. Because of its lower environmental hazard, carbaryl is used extensively as a partial substitute for DDT. It appears to be exceeded as an agricultural insecticide only by DDT and toxaphene. In recent years carbaryl has been applied also as a post-bloom apple thinner. (I) Washington, D. C.

Chlorinated Hydrocarbons. Production of aldrin, chlordane, dieldrin, endrin, heptachlor, Strobane, and toxaphene as a group was 10 percent higher in 1966 than the previous year. Aldrin and heptachlor are used as soil insecticides in the corn belt, three to five million acres there being treated annually to control corn rootworms and certain other soil pests affecting corn. The value of polychlor insecticide exports rose to \$21.6 million in 1966, 41 percent above 1965. (I) Washington, D. C.

Cubé. Cubé root (whole and powdered) imported in 1966, all from Peru, totalled over 4 million pounds with a value of \$465,720. Not since 1959 have imports reached this level. Peruvian cubé has been the chief source of

rotenone insecticides for many years. When demand declines, cube¹ growers make fewer new plantings. This affects supplies for two or three years because of the time required for plantings to be ready for harvest.

(I) Washington, D. C.

DDT. Consumption in the United States continues to decline. It was down 14 percent in the 1965-66 crop year from the previous year and 42 percent from the peak in 1958-59. Production in the first eight months of calendar 1967 amounted to 76.0 million pounds, down 24 percent from the same period a year ago. Exports of DDT during the first six months of 1967 were 14.5 percent lower than in that period in 1966. U. S. shipments of the 75 percent DDT formulation to India declined from 20.4 million pounds in 1964 to 5.8 million in 1966. At the same time shipments to Pakistan rose from only 47 thousand to 16.4 million pounds. This 75 percent formulation is used chiefly in the WHO program to eradicate malaria mosquitoes. (I) Washington, D. C.

Herbicides. Herbicides continue to be the most dynamic aspect of growth in pesticide use. Manufacturers' sales of organic herbicide chemicals in 1966 amounted to \$257,383,000 compared to \$207,276,000 the previous year. The share of all sales of organic pesticides represented by herbicides reached 44 percent in 1966. The United States exported herbicides in 1966 valued at \$37 million, up 26 percent from 1965. The increase was mainly in formulations. (I) Washington, D. C.

Malathion. Demand for this insecticide has been heavy since the development of its use undiluted as an ultra low volume spray. Industry sources expected a 20 percent increase in malathion consumption in 1967 over 1966. The only other insecticides registered for ULV use are naled, toxaphene (also a DDT-toxaphene formulation), and Guthion. (I) Washington, D. C.

Nicotine. Imports of nicotine in 1966 were 3 percent above 1965 although they were valued at 20 percent less. The United Kingdom supplied 65 percent, Netherlands 12 percent, Bulgaria 10 percent, and other countries smaller quantities. (I) Washington, D. C.

Organophosphorus Insecticides. U. S. production of organophosphorus insecticides in 1966 was 120,168,000 pounds, up 26 percent from the 95,328,000 pounds produced the previous year. Methyl parathion made up 30 percent and ethyl parathion 16 percent of the 1966 production. Methyl parathion production during the first six months of 1967 was down 17 percent from the same period in 1966. Owing to reductions in cotton acreage, U. S. consumption in 1966 and 1967 was lessened. Exports of phosphorus insecticides (both technical and formulations) in 1966 were valued at \$33 million, 58 percent above 1965. (I) Washington, D. C.

Pyrethrum. Pyrethrum is imported from Africa and South America as both the dried flower heads and the extract containing 20 percent pyrethrins, the active principles. Most U. S. processors no longer have extraction facilities but depend upon imports of extract. The total value of pyrethrum imports (flowers and extract) in 1966 amounted to \$7,588,000 of which 19 percent came from South America. U. S. imports of pyrethrum extract in 1966 amounted to 725,933 pounds, up 18 percent from the 613,151 pounds imported in 1965. Combined imports from Kenya and Tanzania accounted for 73 percent of the volume in 1966. Shipments from Tanzania and Ecuador were down from 1965, but increased shipments from Kenya more than made up for the difference. (I) Washington, D. C.

Basic Data for Emergency Planning. The 1967 Pesticide Review was printed and distributed in November to interested government agencies (Federal and State), and industrial and related organizations and individuals. This report formerly known as The Pesticide Situation has been published annually since 1953. The primary objective is to assemble information needed in planning for a national emergency. The report contains available data, both general and specific, on production, foreign trade and domestic consumption. The data are derived from publications and by direct contact with Federal and State collecting agencies, non-government market research organizations and individuals, the chemical industry and trade journals. The information forms the basis for estimating pesticide requirements. The report is in much demand by government agencies concerned with chemicals, the chemical industry generally, and many engineering firms, advertising agencies, financial institutions, trade journals, and consultants. Numerous requests for it are received from abroad. (I) Washington, D. C.

Pre-emergency and Emergency Operations Relating to Production of Crops and Livestock. The Department assembles such data as can be gathered which relate to production capacity, supply and usage level of pesticides. This information is used in estimating requirements under current conditions and for various levels of emergency mobilization. The staff involved collaborates with chemical units such as those in the Department of Commerce, Department of the Interior, and Tariff Commission, working to obtain as complete and useful statistics as feasible. The Business and Defense Services Administration and the Bureau of International Commerce are assisted, upon request, in their consideration respectively of shortages of materials and of shipments of goods under export control. (I) Washington, D. C.

TARGET VI

TO CONTROL PESTS

General

Preventing the Entry of Plant Pests. For quarantine purposes 233,194 planes; 65,143 ships; 33,783,264 motor vehicles (from Mexico); 834 coaches and pullmans (from Mexico); 56,929,668 foreign mail parcels; 208,308 shipments moving interstate; and 98,703 cargo entries under permit were examined. In addition, 29,439,895 pieces of incoming baggage were inspected and the cleaning or treatment of 2,785,138 pieces of cargo was supervised. In performing these activities, 41,015 plant pests were intercepted that would have otherwise entered the country. (I) and (E) Nationwide. 1-A

Pest Interceptions at Ports of Entry. Among the major plant pests intercepted in fiscal year 1967 were: Mediterranean fruit fly 202, oriental fruit fly 48, cherry fruit fly 37, melon fly 3, the olive fly 80, pink bollworm 30, khapra beetle 633, citrus canker 812, sweet orange scab 441, citrus black spot 662, golden nematode 32, and the Mediterranean land snail 110. Preventing the entry and establishment of these and other plant pests has materially aided in minimizing the use of pesticides since most of them would bring about the use of insecticides or fungicides should they gain a foothold in the United States. (I) Nationwide. 1-A

Early Detection of Pests. The remote sensing technique, including infrared and thermal sensing, was tested as a detection tool for the imported fire ant. This detection method is being considered for several other introduced pests such as witchweed, burrowing nematode, and cereal leaf beetle. Early detection of infestations of these pests, while they are still restricted to small areas, may preclude subsequent widespread application of pesticides. (I) Weslaco, Texas. 1-A

Domestic Plant Quarantines. During the year, a continuing effort was made to rewrite the Federal domestic plant quarantines to bring them within the legal framework required by court rulings over the past several years. In addition, the quarantines are being rewritten to simplify and clarify their content so that the cooperators and affected public may more readily understand the provisions of the quarantines. Provision has been made to delegate to USDA inspectors the authority to employ procedures to prevent the dissemination of plant pests new to or not widely distributed through the United States. (I) Hyattsville, Maryland. 1-A

Transit Inspection. Transit inspection is performed to protect the country against insect and plant diseases which would move through ordinary trade channels. It is an important adjunct to the enforcement of Federal domestic quarantines and a necessary supplement to plant pest control programs. The program was reevaluated in Fiscal Year 1967 and the primary emphasis placed on truck movement. It has been determined that trucks transport the vast majority of regulated articles. Trucks are being inspected at truck terminals, weight stations, and at ICC check points. During certain seasons, inspections are made at express offices, airport, and post offices. (I) Nationwide. 1-A

Foreign Plant Pests New to the United States. Six plant pests, not previously known to occur in the United States were reported in Fiscal Year 1967. The most important of these were the European crane fly discovered at Blaine, Washington; white garden snail in Los Angeles County, California; oriental wood borer at Ft. Lauderdale, Florida; and Neotropical corn borer in southern Texas. An eradication program was initiated against the white garden snail by California agencies and detection surveys for the other pests were intensified. Reports on these pests were made through the cooperative national insect detection program. A total of 97 new State records, involving established species still spreading in the country, was also reported. (I) and (E) Nationwide. 1-A

Insect Pest Detection Training. Insect detection workshops were held in Alabama, Arizona, Arkansas, Florida, Hawaii, Maine, Michigan, Nevada, New Mexico, Ohio, Oklahoma, Utah, and Wyoming. These schools were attended by 738 Federal, State and industry entomologists and other qualified agricultural workers. The meetings were organized by State representatives with technical assistance provided by the Agricultural Research Service. The early detection of foreign insect pests which might be introduced into the United States was emphasized. The cooperating workers form a nationwide reporting service ready to function in case of an emergency involving biological warfare. (I) and (E) Nationwide. 1-C

Radio Guidance Improves Pesticide Application. A radio navigation aircraft guidance system modified specifically for the imported fire ant program was introduced in 1966. This system has improved the precision of aerial application of the insecticide and reduced cost. A computer installed in each aircraft receives the signals and automatically charts the position of the aircraft on predetermined flight lines. Several planes can use the system simultaneously. As much as 100,000 acres can be treated in a single day. The system is adaptable for use on other programs where large-scale treatments are used. (I) Hyattsville, Maryland. 1-C

Cooperative Economic Insect Survey. The main objectives of the National insect pest survey is to assist farmers in protecting their crops before widespread damage occurs. Observations and evaluations of insect activity by more than 1,200 volunteer cooperators support the survey. In addition, cooperative agreements provide for survey programs in 29 States. Information on current conditions is issued to 4,000 readers each week in the "Cooperative Economic Insect Report." (I) and (E) Nationwide. 1-C

Imported Fire Ant. Approximately 10 million acres were treated with mirex bait to control the imported fire ant in cooperation with nine southern States. This is an increase of approximately 4 million acres over acreage treated in the previous year. The increase was due to improved techniques including the use of an electronic guidance system. A small infestation discovered in Tennessee in 1966 has been treated and is believed to be eradicated. Studies were conducted to extend the residual effectiveness of control materials. Field trials were designed to test alternate carriers capable of absorbing more soybean oil and mirex than the standard corncob grit. In addition, an encapsulated formulation of the oil and toxicant was tested to determine its acceptability by foraging imported fire ant workers. (I) and (E) Southern States. 1-C

Japanese Beetle. During the year, over 40,000 traps were used to detect possible spread of the Japanese beetle to noninfested areas. The major discovery was an isolated infestation at Birmingham, Alabama. Treatments were applied to approximately 31,213 acres to control incipient infestations in outlying areas. This pest which attacks roots, foliage, and fruits of many plants has been known in the East since 1917. Its spread west of the Mississippi River has been prevented through an effective containment program. (I) and (E) Nationwide. 1-C

Animals

Screwworm Eradication. In fiscal 1967, more than 6.5 billion sterile screwworm flies were dispersed over parts of the southwestern United States and Mexico. The majority of sterile flies, 73 percent, were dropped in the States of Sonora, Chihuahua, Coahuilla, Nuevo Leon, Tamaulipas, San Luis Potosi, and northern sections of Durango and Baja California. The remainder of sterile flies, 27 percent, were dispersed in a grid pattern over southern and central Texas and southern parts of California, Arizona, and New Mexico. With progress in screwworm eradication and closing of the screwworm stations in Mississippi, Louisiana, Arizona, and New Mexico, Coumaphos at 0.25 percent concentrations now is used only periodically where screwworm infestations occur. In 1967, confirmed screwworm cases in the United States totaled 1,668. In the barrier zone of Mexico 8,434 confirmed screwworm cases were found. (I) Mission, Texas. 22-C

Field Crops

Stem Rust Controlled by Eradicating Alternate Host Plant. Annual losses to small grains from stem rust in the barberry eradication area have been reduced to about 1/3 of the level existing in 1918 when the program was started. During Fiscal Year 1967 about 1,447,000 rust susceptible barberry bushes were destroyed in 15 States in the continuing effort to eliminate barberry from principal grain-producing areas. The barberry is an alternate host for the rust. (I) and (E) Western, Central, and Eastern States. 32-B

Cereal Leaf Beetle. The cereal leaf beetle, first discovered in the United States in southeast Michigan in July 1962, now occurs in wider areas of that State, Indiana and Ohio. The grain pest has also been found in six Illinois counties and appeared for the first time in Pennsylvania during the spring of 1967. In 1967, 183,000 acres were treated in northwestern Indiana and northeastern Illinois to help retard its western spread. All treatments were with low volume malathion, using four liquid ounces per acre. Due to increasing need for large-scale insecticide applications to control this insect, concerted attention is being given to development of alternate control techniques. (I) and (E) Illinois, Indiana, Ohio, Michigan, Pennsylvania. 32-C

Khapra Beetle. A cooperative eradication program in the United States and Mexico has kept this serious pest of stored grain from becoming established in the two countries. Infestations have been found and eradicated in more than 800 sites in Arizona, California, New Mexico, Texas, and the Republic

of Mexico, since the pest was first found in California in 1953. Prompt detection and treatment of infestations since 1953 have prevented spread of the pest over wide areas of the United States; thus precluding extensive treatments of grain storage sites. More than 11,266 properties were inspected in 35 States in the United States and 9 States in Mexico during the year. No new infestations were found. (I) and (E) Southwestern States, Mexico. 32-C

Biological Control of Cereal Leaf Beetle Accelerated. All phases of a biological control program against the cereal leaf beetle have been accelerated. This pest of cereals, first found in the country in 1962, now occurs in wide areas of Ohio, Indiana, Michigan, and into border areas of Illinois and Pennsylvania. In an attempt to move away from large-scale use of insecticides, particular attention is being given to biological control measures. Approximately 300,000 Anaphes flavipes, an imported wasp parasite of the beetle's egg, were reared and released in Michigan and Indiana during 1967. Other parasites are also being studied. (I) Niles, Michigan. (E) Purdue University, M.S.U. 32-C

Cereal Leaf Beetle Controlled with Less Chemical. Tests in 1966 showed treatment rate for cereal leaf beetle could be reduced from five to four ounces of malathion per acre without reduction in effectiveness. This reduction was possible through the use of low volume application techniques. Additional studies are being carried out in an attempt to further reduce the dosage rate from four to three ounces per acre. (I) Niles, Michigan. 32-C

Witchweed. Witchweed, a parasitic plant which attacks roots of corn, sorghum, sugarcane and other grasses, was discovered in North Carolina and South Carolina in 1956. Eradicative herbicidal treatments have reduced greatly the incidence of the weed and the rate of spread. It has been found in only 35 counties of the two States. If this weed were to spread to principal corn, sorghum, and sugarcane areas, more than 81 million acres of these crops would be susceptible to infestation. To successfully produce crops in the invaded areas, multiple applications of herbicides would be required. Over 531,512 aggregate acres of infested cropland were treated with 2,4-D during the year. (I) and (E) North Carolina, South Carolina. 32-D

Grasshopper Control. Grasshopper outbreaks on rangeland in 1966 required treatment in California, Idaho, Montana, New Mexico, Oklahoma, Oregon, Texas, Utah, and Wyoming. More than 1,500,000 acres of rangeland were treated with low volume malathion applied by aircraft at the rate of eight ounces per acre. Surveys indicated that grasshoppers would be less of a problem on western and mid-western rangelands in the summer of 1967. (I) and (E) Western States. 33-C

Range Caterpillar. Severe infestations of this pest in New Mexico reduce range grasses to the point where they will not support grazing animals. In addition, irritating hairs shed by the caterpillars make range grasses unpalatable to livestock. A major outbreak occurred in Colfax and Union Counties in 1966. Infestations were heavy enough on 177,000 acres to require treatment. Good control was obtained with toxaphene at the rate of one pound per acre applied by air. (I) and (E) New Mexico. 33-C

European Chafer. All of the principal grassland areas of the United States fall within the ecological range of European chafer. Since its discovery in New York in 1941, this root feeder has been contained in areas of New York, New Jersey, Pennsylvania, Ohio, and Connecticut. A new infestation was discovered in Massachusetts in the summer of 1966. Soil treatments were applied to 3,269 acres during Fiscal Year 1967 to control the pest. (I) and (E) New York, Pennsylvania, Ohio, Connecticut, Massachusetts. 331-C

Soybean Cyst Nematode. Soybean cyst nematode, first found in this country in North Carolina in 1954, now occurs in 10 States. Two new States, Louisiana and Indiana, were added to the range during the year. The program in operation against the pest is designed to prevent spread until resistant varieties or effective controls can be developed. Excellent progress has been made toward the development of soybean varieties resistant to the nematode. This is an encouraging development because the pest is being found in increasingly large areas of the Mississippi Valley. (I) and (E) South and Midwest. 341-F

Boll Weevil Control in Western States. The westward movement of the boll weevil on the Texas High Plains has been stopped by an all-out cooperative effort which began in 1964. The success of this program has minimized the threat of spread of the serious pest to Arizona, California, and New Mexico where 25 percent of the nation's cotton is grown. Absence of the weevil in these areas precludes the need for growers to use large volumes of pesticide for yearly weevil control. (I) and (E) Lubbock, Texas. 351-C

Boll Weevil Eradication Tests. At Presidio, Texas, and Ojinaga, Mexico, a boll weevil infestation of approximately 14,000 acres is receiving insecticide treatments in a cooperative methods improvement-research effort to determine if boll weevils can be eradicated by the fall diapause treatment. Treatments were made in 1965 using the insecticide malathion. In 1967 treatments again will be made in this area with a new low volume formulation of Guthion. In this same area an isolated field has been set aside for tests using the sterile weevil technique. This was the first time that sterile weevils have been released on a field-scale basis. (I) Presidio, Texas. 351-C

Pink Bollworm Rearing. The pink bollworm is being mass reared and processed to provide sex lure for detection traps in noninfested areas. The ultimate objective of this work is to produce moths in sufficient numbers to initiate an eradication program using the sterile technique. Production reached 300,000 per month during the year. (I) Brownsville, Texas. 351-C

Pink Bollworm Control. Damage and spread of the insect have been held down through quarantine enforcement and the practice of recommended cultural measures by the farmer. The California infestation is still confined to the southern part of the State. A cooperative control program is underway to prevent population buildup and spread to the San Joaquin Valley where 92 percent of the California cotton is grown. (I) and (E) Southern and Western States, Mexico. 351-C

Horticultural Crops

Mediterranean Fruit Fly Eradication. The infestation of this destructive foreign pest of citrus and other fruits and vegetables which was discovered in Brownsville, Texas, and Matamoros, Mexico, in June 1966 has been eradicated. An area of 12,800 acres was treated 16 times with a malathion-bait spray during the campaign. Only 2.6 ounces of malathion per acre were used in each application. The pest has been eradicated from Florida on four different occasions. It does not occur on the United States mainland. An extensive detection trapping program is operated on a continuing basis in the southern States and Mexico to pick up the pest whenever it appears. (I) and (E) Texas and Mexico. 41-C

Surveillance for Foreign Fruit Flies. The detection program for the Mediterranean, oriental, melon, and other important foreign fruit flies was continued in the southern areas of the United States and Mexico during the year. A network of 40,000 traps was maintained in these areas. The only significant discovery was that of the oriental fruit fly at Anaheim, California. Only five specimens were collected in this area despite an intensive trapping effort. Apparently the pest had not become established and was quickly eliminated. (I) and (E) Southern and Western States, Mexico. 41-C

Golden Nematode. Excellent progress continues to be made in the aggressive eradication program of the golden nematode from Long Island, New York. In 1966 all infested potato fields on Long Island had been treated. Surveys since have shown reoccurrence in a few fields. These received treatment during the summer of 1967. During Fiscal Year 1967, surveys for this serious introduced pest were conducted in 19 States. No specimens were found outside of Long Island. (I) and (E) Nationwide. 421-F

Sweetpotato Weevil. The containment program against sweetpotato weevil in seven southern States protects a large segment of the sweetpotato industry from infestation. During the Fiscal Year 1967, 1906 acres and 1,927,870 bushels of sweetpotatoes were treated to prevent damage and spread. In addition, cultural controls were carried out on 21,555 acres. (I) and (E) Alabama, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, and Texas.

426-C

Phony Peach and Peach Mosaic Diseases Contained. The incidence of phony peach disease was found to be only .08 percent in over 5.3 million trees inspected in Fiscal Year 1967. The incidence of peach mosaic was even lower, being only .02 percent in 4.7 million trees inspected. These virus diseases are serious threats to production of certain stone fruits, particularly peaches. Spread of the diseases to new areas has been prevented through destruction of infected trees and the regulation of the movement of plants and propagating material. (I) and (E) Southern and Western States.

431-B

Citrus Blackfly. To keep this dangerous pest out of United States citrus, a preventive program is carried out with the Republic of Mexico where the pest occurs in wide areas. An eradication zone is established in northern Mexico, while the remainder of the country is under a biological control program. Over 1,000,000 host plants were inspected during 1967 with 148,724 receiving treatment. Isolated infestations were eradicated in Key West, Florida, in 1934 and southern Texas in 1956. (I) and (E) Mexico, Arizona, Texas.

44-C

Mexican Fruit Fly Controlled by Sterile Releases. Over 20 million sterile Mexican fruit flies were released in Arizona, California, and Baja California, Mexico, from April to November 1966. The flies are treated by gamma radiation at the new rearing facility at Monterrey, Mexico. The sterile releases are now used to control this serious fruit pest in these areas where chemical treatment was formerly required. (I) Monterrey, Mexico.

44-C

Burrowing Nematode. Survey of all commercial citrus nurseries in Florida was completed in June 1967. While over 680 nurseries were inspected, only 35 new infestations of this root parasite were found. These nurseries were placed under regulations and no shipments can be moved unless they receive the approved treatments. The insecticide treatment of barriers around the infested groves is continuing to be effective in preventing spread. A new type treatment for nursery stock has been developed. This will greatly reduce the regulatory phase of the program. (I) and (E) Florida.

44-F

Forests

Forest Pest Detection Program. Early forest pest detection is a key requisite to prevention and prompt suppression of outbreaks and the avoidance of large scale control programs. The overall pest control effort was strengthened this year when Louisiana joined the cost-sharing program for the recurring phases of pest surveys and control on non-Federal lands. This brings the number of States cooperating with the Forest Service to 24. These States and the National Forests provide surveillance for pest occurrences on 68 percent of the commercial forest land in the Nation. (E) States of California, Florida, Georgia, Indiana, Louisiana, Maine, Michigan, Minnesota, Mississippi, Montana, New Hampshire, New Jersey, New York, North Carolina, Ohio, Oregon, Pennsylvania, Tennessee, Texas, Vermont, Virginia, Washington, West Virginia, and Wisconsin. (I) Washington, D. C. 5-A

Oak Wilt Controlled in Northeast. Federal-State cooperative oak wilt surveys and control were carried out in Pennsylvania, Virginia, and West Virginia. Surveys alone were made in Arkansas, North Carolina, and Oklahoma. In total, some 45 million acres were covered by aerial surveys and about 8,000 infected trees were treated. In a curtailment of chemical use, most of the infected trees were treated by deep girdling or by felling. (E) States of Arkansas, North Carolina, Oklahoma, Pennsylvania, Virginia, and West Virginia. (I) Upper Darby, Pennsylvania, and Atlanta, Georgia. 5-B

Roguing Controls Scleroderris Canker of Pines. Roguing of infected seedlings in nursery beds and discarding infected seedlings during sorting operations was accomplished in a State nursery in Wisconsin and a Federal nursery in Michigan to prevent transporting infected seedlings to field planting sites. Replanting seriously damaged plantations back to pine was avoided. Tests to see if burning would destroy inoculum source so the area could be replanted to pine were installed. (E) States of Michigan and Wisconsin. (I) St. Paul, Minnesota. 5-B

Cultural Practices Used to Control Dwarfmistletoe. Suppression of dwarfmistletoe in connection with silvicultural operations and timber harvest was done in coniferous stands on National Forests in nine western States. In immature stands sanitation was by felling and pruning; in mature stands sanitation was accomplished through logging. Also, logging to recover mortality and to salvage pre-mortality was accelerated. (I) Missoula, Montana; Portland, Oregon; Albuquerque, New Mexico; Ogden, Utah; San Francisco, California; and Denver, Colorado. 5-B

White Pine Blister Rust Control Curtailed in Inland Empire. A systematic economic and biological evaluation of blister rust control on National Forests in northern Idaho, western Montana, and eastern Washington revealed that blister rust was infecting young western white pine stands at an average rate of three percent per year in spite of best known control efforts. As a result, control was curtailed in these areas because of little chance, economically, to bring the stands through to merchantable size. (I) Missoula, Montana.

5-B

Ribes Eradication Controls White Pine Blister Rust. Surveys were made on two million acres in white pine types of the Nation to determine status of the blister rust disease, spread-intensification, control needs, and the best control methods for protection of each stand. These surveys were conducted in some seventeen States. In total, 7.8 million gooseberry and currant bushes on 150,000 acres were destroyed by hand roguing or herbicide treatment to prevent disease spread. (I) and (E) Washington, D. C.

5-B

Cultural Methods Used to Control White Pine Blister Rust. Blister rust cankers were pruned or excised from 1,288,000 infected trees in five States to save the trees from ultimate death by this disease. (E) States of Michigan, Minnesota, New York, Oregon, and Wisconsin. (I) Upper Darby, Pennsylvania, and Portland, Oregon.

5-B

Bark Beetles Controlled by Logging. In lieu of using pesticides, increased effort was placed on logging to control bark beetles wherever lumber markets were available. Examples of the use of logging are: Douglas-fir beetle infestations in northern California and northern Arizona; Mountain pine beetle in Washington, Oregon, Montana, and Colorado; and Southern pine beetle in the South and Southeast. In Idaho and Wyoming, markets are fewer and although every effort is made to control mountain pine beetle by logging, control to date primarily involves cutting and burning infested trees or cutting and treating with toxic oils to destroy the beetle brood. (I) Portland, Oregon; San Francisco, California; Ogden, Utah; Missoula, Montana; Albuquerque, New Mexico; Denver, Colorado; and Atlanta, Georgia.

5-C

Logging and Thinning Controls Mountain Pine Beetle. Mountain pine beetle has a history of developing to outbreak proportions in over-mature and in stagnated pole-size ponderosa pine stands in Washington and Oregon. To prevent beetle outbreaks, merchantable ponderosa pine is being logged and stagnated stands are being thinned to relieve competition and improve tree vigor. (I) Portland, Oregon.

5-C

Balsam Woolly Aphid Detection. An improved procedure was developed for detecting infestations of balsam woolly aphid. Tanglefoot-coated microscope

slides and wire screens are placed at strategic points throughout tree stands to capture the mobile nymphs of the insect. Verification of aphids is by microscopic examination of the traps. The procedure enables entomologists to detect an infestation three to five years earlier than possible with current methods. (I) Atlanta, Georgia. 5-C

Engelmann Spruce Beetle Detection. Natural disturbances in over-mature or dense stands of Engelmann spruce often trigger infestations of the Engelmann spruce beetle that go undetected from the air until the infestations are well advanced. To detect infestations in their initial stages, a ground surveillance program has been established in the Southwest. All spruce stands are being placed in three hazard classes--high, medium, and low--based on tree age and stand conditions. The high hazard stands will be examined annually on-the-ground. Medium hazard stands will be examined every two or three years on-the-ground or whenever stand disturbance is noted during aerial surveys. Low hazard stands will be surveyed only from the air unless stand disturbance is noted. (I) Albuquerque, New Mexico. 5-C

European Pine Shoot Moth. Both Oregon and Washington had an active cooperative detection program for discovery of European pine shoot moth outside the Puget Sound containment zone. No significant outbreaks were found outside the containment zone in Washington. Two separate infestations were found in the Portland, Oregon, area. Infested trees in these two areas were fumigated by the owners at the request of the State of Oregon. Surveys within the containment zone to measure intensification were continued. (E) States of Oregon and Washington. (I) Portland, Oregon. 5-C

Parasites Used to Control Larch Casebearer. Distribution of larch casebearer parasites at new locations to control this serious defoliating insect was continued in 1967. Approximately 575,000 parasitic wasps were liberated in 115 areas in eastern Washington, northern Idaho, and western Montana. Parasites were obtained from a colony established in 1964 near Noxon, Montana. New releases will be made in 1968. (E) State of Washington. (I) Missoula, Montana; and Portland, Oregon. 5-C

Releases of Larch Sawfly Parasite. Biological control of the larch sawfly in Manitoba, Canada, by the parasite Olesicampe, has shown high promise. Canada supplied the United States with 700 of these parasites that were released at two locations in Maine. The parasites were released in stands with moderate to heavy sawfly infestations. It is hoped that establishment of the parasite in Maine will provide control of infestations and a source of material for redistribution to other areas in this country where larch sawfly is a problem. (E) Canada and Maine. (I) Upper Darby, Pennsylvania. 5-C

Virus Promising for Control of Douglas-fir Tussock Moth. Infestations of Douglas-fir tussock moth often suddenly collapse when the larval population becomes infected with a naturally occurring polyhedrosis virus. Recognizing that the virus could possibly replace DDT for control of the insect, researchers in the Northwest produced a supply of the virus for testing purposes. Before the virus could be field tested, local tussock moth populations collapsed. A new infestation was detected in Arizona in 1966 and was intensively studied this year in preparation for a field test of the virus against the insect population in 1968. (I) Corvallis, Oregon; and Albuquerque, New Mexico. 5-C

Non-Persistent Pesticide Tested. Continuing efforts to find a non-persistent insecticide to replace DDT for spruce budworm control led to further field tests of the carbamate insecticide, Zectran, in 1967. The results of these tests were encouraging, averaging about 85 to 87 percent reduction in budworm populations with no measurable adverse effects to fish populations or terrestrial animals. A further test of Zectran applied at one ounce actual per acre in droplet sizes as small as possible with available spray equipment is planned for 1968. If results of this test are favorable, Zectran will be recommended for operational use against the spruce budworm. (I) Ogden, Utah; Upper Darby, Pennsylvania; and Berkeley, California. 5-C

Trap Trees Control Engelmann Spruce Beetle. One method of suppressing Engelmann spruce beetle populations involves felling green spruce, waiting until they are infested by the beetle, and then removing the infested trees from the woods. This method requires careful timing to insure that the infested trees are removed before the contained brood can leave to attack standing green trees. A modification of the "trap tree" method shows promise of eliminating the need to remove the "traps" from the woods. A month prior to beetle flight, green trees were poisoned with a fast-acting herbicide. Two weeks later the trees were felled and were subsequently infested with Engelmann spruce beetle. Preliminary evaluation results showed that at least 90 percent of the brood failed to develop in the poisoned "traps".

(I) Albuquerque, New Mexico; and Denver, Colorado.

5-C

Solar Heat Used to Control Ips Beetles. Further tests were conducted in 1967 to control ips broods in logging slash by encompassing the slash piles with polyethylene sheeting in order to raise temperatures in the piles to a lethal level for ips. Both black and clear polyethylene were used. The clear produced the highest temperatures and resulted in good ips control. This method of preventing ips buildup in slash and possible attack of green standing trees has practical use in recreation areas where burning or chemical treating of infested slash is not always possible or desirable.

(I) Albuquerque, New Mexico.

5-C

Soil-Tilling Controls Strawberry Root Weevil in a Douglas-fir Seed Orchard.

A strawberry root weevil, Brachyrhinus ovatus caused severe damage in a Douglas-fir seed orchard on the Siuslaw National Forest, Oregon. The infestation was successfully controlled by mechanical means (plowing and disking) and a light application of chemical. The soil tilling in combination with pesticide application resulted in cancellation of a second scheduled pesticide application. (I) Portland, Oregon.

5-C

Herbicides Show Promise for Control of Bark Beetles. Studies were made in 1967 on the use of a fast-acting herbicide to reduce bark beetle broods in naturally infested trees. The application of the herbicide was simplified by frilling the trees near the base with an ax and introducing the chemical into the sap stream with a plastic squeeze bottle. In related studies, the herbicide was used to kill standing green host trees prior to beetle flight. This apparently attracted the bark beetles, which attacked the trees, constructed galleries, and laid eggs. In many instances, the parent beetles were killed and the brood failed to develop. (I) Albuquerque, New Mexico; Denver, Colorado; and Portland, Oregon.

5-C

Population Decline Reduces Need for Chemical Control. Close surveillance and sampling of the budworm population on the Sawtooth National Forest, Idaho, led to reducing an aerial spray project from 64,000 acres, as planned, to 2,500 acres. This reduction resulted from a natural collapse of the budworm population. (I) Ogden, Utah.

5-C

Polyhedral Virus Used for Control of European Pine Sawfly. The virus causing the nuclear polyhedrosis of the European pine sawfly is extremely effective in suppressing its host. Before this material can be used operationally to control the sawfly, additional information is needed to meet requirements of registration by the USDA and the FDA. This year, in a joint effort between Research and Forest Pest Control, over a quarter of a million sawfly larvae were collected and infected with the virus. About one pound of the virus was recovered from rearing operation and the material is now being used by Research for the necessary testing. Plans are to produce another pound of the virus, by similar means, next year. (I) New Haven, Connecticut; and Upper Darby, Pennsylvania.

5-C

Bacterium Tested for Fall Webworm Control. The fall webworm is a rather general feeder, known for defoliating deciduous trees throughout many parts of the United States. The damage caused by this insect becomes important in scenic and recreation areas. Laboratory screening of several insecticides against the larval stages of this insect has shown that Thuricide 90 TS, a formulation of the bacterium Bacillus thuringiensis Berliner, is a good candidate to replace DDT for control of this pest. (I) Albuquerque, New Mexico.

5-C

Formosan Subterranean Termite. The Formosan subterranean termite was first found in the continental United States in July 1965 in a shipyard warehouse in Houston, Texas. Since that time infestations have been found in Galveston, Texas; New Orleans and Lake Charles, Louisiana; and Charleston, South Carolina. This termite has been known to exist in China, Guam, Hawaii, Japan, the Philippines, South Africa, and Taiwan for many years where its damage to various structures has been a serious problem. Introduced into Hawaii around 1900, it is one of the Islands' most serious pests, causing more than \$2 million damage annually in Honolulu alone. Emergency regulations are being cooperatively enforced by the States of Louisiana, South Carolina, and Texas to prevent the artificial spread of the pest from the known infested properties. (I) and (E) Southern States. 5-C

Gypsy Moth Containment. Containment of the gypsy moth in the Northeast has protected more than 100 million acres of susceptible forests in 25 States in the eastern half of the nation. In the spring of 1967 chemical controls were applied to 151,000 acres in outlying infestations in New Jersey, New York, and Pennsylvania to halt spread. An isolated infestation was discovered in Michigan in 1954, this was declared eradicated in 1961. A small infestation was discovered in Michigan again in 1966. This infestation, consisting of 24,300 acres received eradivative treatment in the spring of 1967. (I) and (E) Northeastern States. 5-C

Sterile Technique Tested on Gypsy Moth. The sterile male technique for control of gypsy moth has been studied in the laboratory and in the field on Cape Cod, Massachusetts, for the past three years. In 1967, the first direct control effort using sterile males was made against a natural population. Over 40,000 moths were released in Pennsylvania and New York. Mass rearing proficiency is being developed to support a large-scale sterile moth program. If this program is successful, the population of the moth may be reduced to non-economic levels, thus eliminating the need for large-scale use of pesticides. (I) Cape Cod, Massachusetts. 5-C

TARGET VII

TO MONITOR THE PRESENCE AND DISTRIBUTION OF PESTICIDES IN PLANTS, ANIMALS AND THEIR PRODUCTS, AND IN THE ENVIRONMENT

National Soils Monitoring Program Initiated. A pilot study for an expanded National Soils Monitoring Program was conducted in Maryland in October 1966. This new nationwide program will be initiated in five States in Fiscal Year 1968 and will involve sampling of approximately 15,000 locations over a 4-year period. (I) Maryland.

Results of Pilot Soils Monitoring Study. The nationwide pilot-scale soil monitoring study revealed that DDT was the most commonly encountered pesticide on high pesticide use areas, averaging 3.31 ppm on 45 selected cropland fields and 31.61 ppm in 25 orchards. Low levels of DDT (0.3 ppm) and dieldrin (0.02 ppm) were found in about half of the areas sampled where pesticides are used occasionally, and residues have been detected thus far only in samples from one sampling site where no pesticides were reported to have been used. This land, now in forest, had previously been farmland. (I) Nationwide.

Monitoring Soil and Root Crops for Pesticide Residues. Sampling of soil, potatoes, peanuts, and carrots in several Eastern States revealed that DDT was the most widely distributed pesticide in the soil in the area studied and occurred in the three crops from some fields. The highest concentration was found in carrots at 2.31 ppm. Dieldrin residues were found in soil from five peanut fields sampled and residues of this insecticide at levels up to 0.13 ppm were detected in peanuts grown in these fields. This apparently was a result of translocation from the soil. The selected fields had a history of chlorinated hydrocarbon insecticide use. (I) Eastern States.

Monitoring Chlorinated Hydrocarbon Insecticide Residues in Soybeans.

Pesticide residues were found in some soybean seed samples from the Midwestern, Southern, and Southeastern States during the year. About three-fourths of the soybean samples from Arkansas and Mississippi contained endrin residues (up to 0.17 ppm). About 23 percent of the samples from the Midwestern States contained dieldrin at concentrations of .01 to 0.04 ppm. DDT was found in about 16 percent of the soybean samples from the Midwestern States with a high concentration of 1.11 ppm. The kinds of residues were tied closely to the pesticide use on other crops in the areas. Contamination may have occurred through translocation from the soil as a result of soil residues from previous crops, drift, inadvertent overspray, or direct misuse of the pesticide. (I) Midwestern, South, Southeast.

Monitoring Forest Insect Spraying. Monitoring programs carried out on two forest insect aerial spray projects revealed no apparent adverse effects to fish, wildlife, domestic livestock, and domestic water supplies. Assisting in the complex monitoring programs were scientists from the Bureau of Sport Fisheries and Wildlife Service, State fish and wildlife agencies in Maine and Idaho, and biologists from the University of Maine. (E) Idaho and Maine. (I) Ogden, Utah; and Upper Darby, Pennsylvania.

Pesticide Drift Studies. The problem of drift is receiving close attention on cooperative large-scale control programs. Tests were conducted during the year using the low volume application technique. These trials included testing of various atomizing devices designed to reduce or control drift through control of droplet size. (I) Bozeman, Montana.

Monitoring Program for U. S.-Produced Meat. The tissues of food-producing animals slaughtered in federally-inspected plants located throughout the United States were monitored for the presence of pesticide residues. The program randomly collected and analyzed 2,131 tissue samples of which 1.03 percent contained an illegal amount of pesticide residue. Analyses of suspected meat (total of 108 samples) revealed illegal residues in 7.4 percent of the tissue samples. These samples were taken where there was reason to suspect misuse of a pesticide.

Monitoring Program for Imported Meat. Imported meat is monitored for pesticide residues. Results of analysis of random samples (515) indicated that 2.33 percent of samples contained residues above accepted tolerances. Where the survey shows that a foreign country has a residue problem, extensive sampling of each lot is required before passing for entry.

TARGET VIII

TO ADMINISTER THE REGULATORY STATUTE-- THE FEDERAL INSECTICIDE, FUNGICIDE, AND RODENTICIDE ACT-- TO ASSURE PROPERLY LABELED PESTICIDES, WITH GUIDELINES FOR THEIR SAFE AND EFFECTIVE USE, AND TO PREVENT THE MARKETING OF HARMFUL, ADULTERATED, OR MISBRANDED PRODUCTS

Registration of Pesticides and Other Economic Poisons. The Act regulates the marketing of insecticides; fungicides; rodenticides; herbicides; nematocides; disinfectants, and sanitizers; poisons and repellents for pest birds, mammals, reptiles, amphibians and invertebrate animals; plant regulators, defoliants and desiccants. Such products are required to be properly labeled and registered with the Department prior to interstate shipment. Registration is based on labeling and data supplied by the applicant. Evidence must be submitted to show that the product will be safe and effective when used as directed. Labeling requirements are designed to guide the user in safe and effective use. New regulations requiring the statement "Keep Out of Reach of Children" and other warning and caution statements to be on the front panel, and placing of the USDA registration number on the label became fully effective October 1, 1966. These new regulations were first issued in 1964. All new products submitted for registration since May 1964 and all revised labeling submitted since January 1, 1965, have been required to bear this stronger precautionary labeling. However, in the interest of public protection, it was decided that labeling submitted in accordance with these new regulations should be reviewed in its entirety; i.e., claims, directions for use, statement of composition and other required precautionary labeling, including that for protection of fish and wildlife. Therefore, products now being legally marketed should bear labeling which has been reviewed in accordance with the latest available scientific information and legal requirements. Although the number of new products registered in 1967 decreased slightly from that of the previous year, the number of amended labels accepted increased by 64 percent. (I) Washington, D. C.

Product Surveillance. This activity was also increased in fiscal year 1967. At the beginning of the year there were 15 inspectors engaged in the surveillance of pesticide shipments, collection of samples, and investigation of accidents caused by pesticides. By the end of the year, the number of inspectors had been increased to 25, operating under five regional supervisors. During the year, the Division processed 4,958 samples taken from interstate shipments. Of this number, 781 were in violation of the Act to the extent to warrant citation and/or seizure. In addition, 366 products were less serious in violation and were corrected by means of correspondence. Seizure actions were initiated on 189 shipments. During the 1967 fiscal year, 5,145 samples were collected by the inspectors. This compared with 3,489 samples collected for fiscal year 1966. For the fiscal year 1967, there was an increase of 78.3 percent in seizures, 29.8 percent increase in citations, 94.6 percent increase in correspondence, 80.2 percent increase in the number of samples processed, and 47.3 percent increase in the number of samples collected. The principal violations continue to be nonregistration, ineffectiveness, and chemical deficiencies. Ineffective disinfectants run at a high percentage. Violations involving lack of required precautionary labeling and the registration number have resulted in a large number of seizures and notices of violations since October 1, 1966. (I) Washington, D. C.

Product Surveillance - Seizures. Unregistered, adulterated, or misbranded products may be seized in the interest of public protection. In 1967, 189 shipments were seized. Examples of the types of violations found are (1) A shipment of insecticide totaling 48,000 pounds which was misbranded because it contained less active ingredient than declared on the label and would have been ineffective against the insects named, (2) a shipment containing more than 3,500 one-pound containers of a germicide which would have been ineffective for the purposes claimed, (3) a shipment of a biological insecticide amounting to over 2,000 pounds because it contained insufficient active material to be effective, (4) a 1,200-pound shipment of herbicide because it was not registered and was misbranded because the label did not bear required precautionary labeling, and (5) a shipment of 8,500 pounds of a fungicide imported from Mexico because it was unregistered and failed to bear required labeling. (I) Washington, D. C.

Interdepartmental Coordination of Activities Relating to Pesticides. This activity continued under the terms of the interdepartmental Agreement on registration of pesticides. Applications for registration are referred to the Department of Health, Education, and Welfare and Interior for advice on labeling requirements. Because of the increase in labeling submitted for registration, referrals to the other agencies increased 101 percent over the previous year. (I) Washington, D. C.

Dissemination of Information on Registered Uses. The Pesticides Regulation Division issues the USDA Summary of Registered Agricultural Pesticide Chemical Uses which is a compilation of abstracts of registered pesticide use patterns involving food, feed, and fiber crops. This summary is available to, and is widely used by, registrants, Federal and State extension and research agencies and food processors. It serves as a guide in the preparation of labeling and recommendations for pesticides. More than 600 use patterns for over 400 chemicals are listed. Changes or additions to the listings are incorporated into supplements which are issued periodically to holders of the Summary. In cooperation with the Federal Extension Service under an agreement begun in 1967 that agency is notified on a weekly basis of changes or additions. This information is in turn transmitted to their personnel in the field in order that they may be kept current on new or changed pesticide registrations. During fiscal year 1967, 183 changes or additions to Summary listings were issued. (I) Washington, D. C.

TARGET IX

TO EDUCATE AND INFORM THE PUBLIC ABOUT THE IMPORTANCE
OF PESTICIDES AND PEST CONTROL, AND THE NEED FOR SAFE
AND PROPER USE OF PESTICIDES; MAINTAIN A PESTICIDES
INFORMATION CENTER; COORDINATE AND REVIEW
PESTICIDE AND PESTICIDE-RELATED ACTIVITIES
OF THE U. S. DEPARTMENT OF AGRICULTURE
AND COORDINATE THEM WITH OTHER
FEDERAL, STATE, AND PRIVATE
ORGANIZATIONS

Information-Education

The Department's continuing national pesticide safety-pest control information and education program was further intensified and broadened during 1966-67. The program placed renewed emphasis on describing (1) the challenge of pests and the importance of pest control to modern society, (2) the need for prudent, safe use of pesticides and related governmental safeguards, and (3) the development of additional safe and effective methods of control. The audience for this program was both the general consuming public and specific interest groups, including housewives and gardeners, farmers and ranchers, commercial applicators and food processors, dealers and manufacturers.

Within the Department, the information-education program was carried out by the Office of Information, Agricultural Research Service, Federal Extension Service, Forest Service, and other concerned agencies with the Office of Information acting as coordinator. In turn, Department activities were closely linked with those of the States through the Cooperative State Extension Services, and with other Federal Departments, educational institutions, and private organizations. The mass communications media--newspapers and magazines, television and radio--continued to offer excellent cooperation in the use of program materials for public consumption. Here are the highlights of the 1967 program as conducted by the USDA and its cooperators:

Radio and Television

Safety Announcements. For the fourth successive year, the Advertising Council notified the nation's broadcasters that it had renewed its endorsement of the USDA pesticides safety program for 1967. The Council's valuable support resulted in extensive public service use of recorded spot announcements supplied to more than 4,500 radio stations, and filmed 20-second spots, in color, distributed to the three major television networks and over 600 commercial TV outlets. The TV material was produced in consultation with the networks in compliance with the highest public service standards. The Cooperative Extension Service used these announcements in programs for State and local groups. The spots emphasize the importance of pesticides as well as the need for safety. (I) Washington, D. C.

Features. Pest control research, regulatory, and monitoring activities of the Department's Agricultural Research Service were reported in at least 28 different features heard on weekly and monthly radio and television programs produced by USDA broadcasting services. Two 3-minute television films on the Department's pesticide monitoring program were widely distributed, along with five TV and more than 50 radio spot announcements telling the plant quarantine story. The public was kept informed on field research and control projects through news items and interviews broadcast over local stations. Broadcast material stressed the precautions taken to assure maximum safety for people and wildlife.

State Safety Spots. The State Extension Services developed a variety of visual materials on safe and proper use of pesticides for television. Under a cooperative agreement with the Department, the Maryland Extension Service produced a series of visuals which included the second set of ten Larry the Label TV spots. This makes a total of 20 spots, of which 4,240 copies were purchased for use in every State. Under a similar agreement, Florida developed a comprehensive pesticide safety packet including two TV spots--a 60-second Al Capp spot and the Pesticide Swinger spot--and also a disc recording and a 14-1/2-minute film on poison cases in the home. The Kansas State Extension Service turned out 26 spot announcements on safety and the need for pesticides. (I) and (E) Washington, D. C., and States indicated.

Schools, Youth Groups

Information for Schools. Some 34,000 packets containing information on pests and their control were distributed to general science and biology teachers in junior and senior high schools, elementary science supervisors, college

instructors, vocational agriculture teachers, and other educators beginning in February. Designed primarily for classroom use, the packet was prepared in consultation with the National Science Teachers Association (NSTA), a division of the National Education Association (NEA), with initial distribution through the NSTA to its 27,000 members. It included a 24-page illustrated booklet, Our Struggle Against Pests, written for students, three student or classroom science projects, the guide for a new 66-frame film strip, Man Against Pests, and other items. Teachers subsequently ordered directly 170,000 copies of the packet materials for classroom use. Numerous State, county, and city school officials requested packets in quantity for their school systems. (I) Washington, D. C.

Youth Organizations. The pest control information packet prepared for the schools also was used by the Boy Scouts of America (2,500 packets), Girl Scouts, and the Future Farmers of America (FFA). 4-H Clubs requested and received 500 packets and 160,000 copies of packet publications. High school students who visit agriculture research facilities at Beltsville, Maryland, are given the basic packet materials. The packet presents young people with a comprehensive, balanced approach to the present and future challenges of pest control in the areas of research, regulation, monitoring, and education. (I) Washington, D. C.

Special Projects

Pesticide Safety Cartoons. Forty-eight different cartoons offering tips on pesticide safety to housewives, gardeners, farmers, vacationers, and other users were produced by the Department and made available by the Newspaper Enterprise Association to approximately 750 daily newspapers at the rate of four a month from October 1966 through September 1967. The cartoons were also supplied directly to more than 60 of the Nation's largest metropolitan newspapers, to trade journals, and chemical firms, and to weekly newspapers through the Cooperative Extension Service. The Newspaper Enterprise Association found that the cartoons were used extensively by daily newspaper editors, and it is now offering them to an additional 175 daily newspaper clients. (I) Washington, D. C.

Family Health Information Centers. By special arrangement with the American Pharmaceutical Association, 400 family health information centers located in independent pharmacies throughout the Nation began periodic displays of USDA pesticide safety literature. The first such two-month display this summer offered 40,000 copies of PA-589, Safe Use of Pesticides...in the Home...in the Garden, to drugstore patrons. The program will continue through the

summer of 1968 with at least four Department pesticide safety items scheduled for display and distribution through the family centers to housewives, homeowners, and others. (I) Washington, D. C.

Pesticides Registration. In support of increased registration activities, a brochure, Pesticide Registration--How It Protects You, was prepared by ARS for public distribution, an exhibit was displayed at the Agriculture/2000 Science in the Service of Man Open House, Beltsville, Maryland, and a speech kit, Prevent Pesticide Accidents Thru Education, was produced for the use of pesticide safety leaders. In addition, a publication, Planning to Register A New Pesticide Product? along with two flyers explaining changes in the registration procedure were published and distributed to the pesticide industry. ARS registration officials took part in TV shows in Oakland, California, and Orono, Maine, and USDA articles on registration policy appeared in national trade magazines. A study was undertaken designed to improve pesticide labels from the standpoint of user safety. (I) Washington, D. C.

Pestina Campaign. In support of the domestic and foreign plant quarantine programs that tend to lessen the need for pesticide use, the ARS public information campaign built around the Pestina symbol accelerated with the issuance of hundreds of news stories, more than 50 radio spot announcements, five TV spots that went to over 200 stations, posters for post offices and Customs offices, and exhibits at fairs and airports. In addition, a new 13-1/2-minute color movie, Among Your Souvenirs, was produced and released for the use of travel agencies and the transportation industry. Precautionary flyers, printed in seven languages, were developed for use aboard passenger and cruise ships. Information efforts also were directed to specific groups such as garden clubs, military personnel, nurserymen, and transportation companies that most needed to know the hazards of moving plants from place to place in the Nation. (I) Washington, D. C.

Forest Pest Control Information Programs. Forest insect aerial spray projects were preceded and accompanied by intensive and carefully planned efforts by the Forest Service to inform local citizens about the forest insect outbreak, its seriousness, proposed course of action, and steps to be taken to insure that the pesticide used will be applied safely. Pertinent information was disseminated through civic groups, special meetings, press briefings, news releases, brochures, and invited biologists who described how distribution of pesticides in the environment would be measured and controlled. This broad-scale informational approach was used successfully when the USDA cooperated with the State of Maine in the public information and monitoring aspects of a spruce budworm control project involving 100,000 acres of private land near Presque Isle. (I) and (E) Washington, D. C.; Maine.

Public Attitude, Knowledge Surveys. Public attitude and knowledge levels concerning pesticide chemicals usage were surveyed in Colorado, Iowa, and Virginia for the Cooperative State Extension Services and the Federal Extension Service. The surveys included farmers, housewives, dealers, and other Extension audiences and were conducted in both rural and urban areas with sociologists and other educators as advisors. Findings from these surveys indicated a need for more intensified educational effort on various aspects of pesticide usage. Survey results are being used to plan future information and education programs in this subject area. (I) and (E) Washington, D. C., Colorado, Iowa, Virginia.

Michigan Projects. In cooperation with the Department (FES), the Michigan State Cooperative Extension Service carried out two projects concerned with: (1) Determining the pesticide residue levels in soil, water, and crops resulting from the use of pesticides based on extension pesticide recommendations, and (2) determining the correlation of cholinesterase levels in the blood of spray operators exposed to cholinesterase-inhibiting pesticides and measuring the impact of a cholinesterase-testing program as a part of a pesticide safety program. In discussing the value of the projects, the summary report states "...no other singular measure could have more efficiently created an awareness and interest in sound pesticide-chemicals practice for Michigan." Findings in the studies indicate possible new approaches to pesticide safety. (I) and (E) Washington, D. C., Michigan.

Pesticide Use Records. The Department and the State Extension Chemical Coordinators/Leaders stressed the importance of pesticide-chemical users keeping complete and detailed long-range records in meetings with producer, commodity, organization, applicator, pest control operator and industry groups. The record book developed cooperatively by North Dakota and the Department (FES), last year has been well received. Most States are now encouraging pesticide-chemical users to keep records as a means for preventing undue losses, due to excessive residues, liability suits, minimizing environmental contamination and promoting safe use. (I) and (E) Washington, D. C. and North Dakota, other State Extension Services.

Evaluating Field Use of Systemics. The California State Cooperative Extension Service and the Department (FES), conducted a project which involved studying the use and effects of systematic pesticides on livestock. The initial phase of the study involved a planned program of field animal treatments in different regions under the supervision of professionals from the University of California. The second phase concerned investigations of animal treatment and types of reactions following reports of toxicity cases. (I) and (E) Washington, D. C., California.

Publications

Popular Publications for General Distribution. More than 200,000 copies of the 24-page illustrated booklet, Our Struggle Against Pests, were distributed to schools, scouting groups, civic clubs, gardeners, housewives, and homeowners. A 17-page booklet, Federal Committee on Pest Control... What It Is, What It Does, was prepared in cooperation with the FCPC and issued through the facilities of the Department as part of USDA support for interdepartmental coordination in the pest control field. A brochure, Pesticide Registration -- How It Protects You, was prepared to explain the purpose and procedures of registration to the public. Some 35,000 copies of the booklet, Saving Our Forests, were sent out to explain how USDA forest insect and disease control programs were carried out. Nearly 75,000 copies of the pamphlet, Safe Use of Pesticides... In the Home, In the Garden and some 8,000 copies of Farmers Checklist for Pesticide Safety received public distribution. (I) Washington, D. C.

Fact Sheets. More than 50,000 copies of a revised edition of the 12-page fact booklet, The War That Never Ends... Facts About Pest Control, which outlines Department policy and activities in the pest control field, and over 20,000 copies of the four-page fact sheet, Your Home and Safe Use of Pesticides, were distributed to the nation's schools and colleges, civic organizations, and other groups. New revised editions of both publications have been prepared for distribution to the general public during 1968. These fact sheets were also distributed by the Food and Drug Administration and the Public Health Service of the U. S. Department of Health, Education and Welfare. (I) Washington, D. C.

New Agriculture Handbooks. The first comprehensive reference guide on safe use of pesticides, AH No. 321, Safe Use of Agricultural and Household Pesticides, was prepared by ARS and placed in the hands of county Extension agents, State agriculture officials, libraries, and other educational experts and institutions. Over 1,000 copies were distributed to leading national and international scientists at a pesticides symposium sponsored by the New York Academy of Sciences in May. Another new handbook, AH No. 332, Suggested Guide for Weed Control, containing information on chemical and other means of control was issued by ARS as a companion reference volume to the annual insecticide guide. Both publications include extensive precautionary information for the safety of the user and the prevention of crop and livestock residues. (I) Washington, D. C.

Publications Updated. Approximately 90 additional Department publications on crop, livestock, and forest pests, an increase of 30 over the previous year,

were revised by ARS and Forest Service to include the most advanced pesticides information in relation to USDA pest control policy, the latest research developments on safety and control methods. (I) Washington, D. C.

Cooperative State Extension Services. Two publications, an Agricultural Pesticide Handbook and a Pesticide Information Manual, were developed by the Cooperative State Extension Services of Missouri and the Northeastern States, working with the Department (FES). Both of these publications have been distributed nationally and have been well received and commented on favorably by industry and government personnel. The Missouri Handbook lists pesticide-chemical uses by crops, and the Northeastern Manual provides general information on most aspects of chemical usage. Both publications will have additional sections and/or revisions added periodically to keep them up-to-date. (I) and (E) Washington, D. C., Missouri, Northeastern States.

News Releases, Feature Stories, Newsletters

Press Releases and Articles. A substantial increase was recorded in the amount of information released to news media on the Department's pesticide and pest control activities. More than 250 press releases, the majority from ARS, and 67 articles published in the Agricultural Research magazine kept the public informed on the new pesticide regulations, the monitoring and control programs, and the latest developments in pest research, including new, non-chemical control methods. (I) Washington, D. C.

News Interpretation for States. Through newsletters and telephone calls, the Federal Extension Service keeps the States informed of special news releases, pesticide regulations, registration changes, and similar developments that may have a bearing on particular State programs. These newsletters have included information on and interpretations of such matters as milk indemnity programs, cancellation of registered pesticide uses, cancellation of the no residue-zero tolerance concept, and problem situations concerned with pesticide residues in meats and other food products. (I) Washington, D. C.

Newsletters. All States have developed and are using newsletters as their primary means for reaching and communicating with specific clientele groups which include dealers, applicators, pest control operators, producer groups and others. Almost without exception, State Extension specialists and county agents depend on this expedient means for disseminating pesticide-chemicals information on registered uses, cancellations, safety, storage, etc., to their various audiences. (I) and (E) Washington, D. C., and State Extension Services.

Instruction and Training

Regional Applicator Schools. The Department (FES) and State Cooperative Extension Services sponsored and conducted nine regional applicator schools for aerial and ground pesticide-chemical applicators and pest control operators during 1967. Registered attendance at these schools totaled some 2,000 persons, composed of applicators, pest control operators, and representatives from industry, government agencies and organizations concerned with pesticide use safety and protection of the environment. Topics covered in depth at the 2-3 day schools included: Pesticide chemical application techniques, low and ultra low volume application selection and calibration, safety, toxicities, registration, mode of action, liability, record keeping, disposal and use problems, etc. (I) and (E) Washington, D. C., and State Extension Services.

Programmed Instruction. A project to develop and evaluate the use of programmed instruction for communicating pesticide-chemicals information to commercial applicators was conducted by Colorado Extension Service in cooperation with FES. A similar text, aimed at individual study was developed by West Virginia Extension for use among youth and homemaker groups. Announcement copies of the West Virginia text and leader's manual--entitled Prevent Accidental Poisoning in the Home, and the Colorado Programmed Guide entitled Pesticide Chemicals have been forwarded to all States and additional copies have been made available on a cost-purchase basis. (I) and (E) Washington, D. C., Colorado, West Virginia.

State Training Conferences, Schools, and Workshops. A number of Extension pesticide training conferences, schools, and workshops were held in the States. A survey of twelve States indicated that an average of 10,000 custom spray operators, dealers, and applicators, consumers, home economics groups and chemical company representatives attended the meetings in each State. The North Carolina Extension Service worked through community colleges in holding 12-hour courses for garden supply dealers and others. (I) and (E) Washington, D. C., North Carolina, State Extension Services.

Speeches and Conferences

Speech Kit. A pesticide safety speech kit entitled, Prevent Pesticide Accidents Thru Education, was prepared cooperatively by the Agricultural Research Service, Federal Extension Service, and the Office of Information. It included summaries of 62 pesticide accident investigations conducted by the Department, a suggested speech, charts, narrative guide for the color slide set, Safe Use of Pesticides, and the pest control fact booklet, The War That Never Ends.

10,000 copies of this kit were distributed through USDA agencies, the Federal Committee on Pest Control and other concerned Federal and State agencies to county agents and field personnel for use in talks before civic groups, farm audiences, garden clubs, and other organizations interested in the safe use of pesticides. (I) Washington, D. C.

Department Speakers. Department officials and scientists led by the Secretary of Agriculture, the Assistant Secretary for Science and Education, and the Administrator of the Agricultural Research Service explained in numerous speeches USDA policy on pesticides and pest control as well as specific aspects of Department research, regulation, control, monitoring, and education programs. Some of the influential organizations and national conferences they addressed included the National Science Teachers Association, the American Association for the Advancement of Science, the New York Academy of Sciences, Conference on Educational Aspects of Pesticide-Chemicals Usage, Federation of American Societies for Experimental Biology, American Beekeeping Federation, Weed Society of America, and the First Florida-Latin American Agricultural Conference. (I) Washington, D. C.

State Extension Leaders. USDA pest control policy and programs were discussed and explained by State Extension Pesticide-Chemical Leaders/Coordinators before more than 5100 State and local chemical, aerial applicator, fish and game, dealer, consultant, Public Health, conservation and commodity groups concerned with various aspects of the safe and proper use, storage and handling of pesticide-chemicals. This represented an audience of over 200,000 persons. (E) State Extension Services.

Colorado Conference. International, national, and state educators, scientists, and communicators addressed the Conference on Educational Aspects of Pesticide-Chemicals Usage at Colorado State University, Fort Collins, in July. The event was sponsored jointly by the Department (FES) and the University. Attending were 125 representatives from 42 State universities, 13 chemical companies, six trade associations, six government agencies, and four foreign countries. In addition to the formal addresses, the meeting offered the opportunity for full discussion of pesticide education problems involving Federal and State agencies and industry. (I) and (E) Washington, D. C., Colorado.

Motion Pictures, Slides, Photo Stories, and Other Visuals

Motion Pictures. Pests or Plenty?, the 13-minute, consumer oriented color film on protecting our food supply from pests was seen by an estimated 3-1/2 million viewers in the year ending June 30. The movie had 80 television showings and 435 screenings before live audiences. Safe Use of Pesticides,

the 28-minute film advising the agricultural producer on how to avoid crop residues, had 11 television showings and 767 screenings before live audiences. An estimated half-million people saw this motion picture during the 1967 fiscal year. A new 13-1/2-minute color film, Among Your Souvenirs, was produced in support of the plant quarantine program and released for the use of travel agencies and the transportation industry. (I) Washington, D. C.

Picture Stories. The benefits to human health of safe, effective use of pesticides were underscored in a picture story on poison ivy identification and eradication offered to seven national news syndicates and 600 daily newspapers and house organs. The story stressed poison plant eradication with herbicides around homes and recreation areas. A television color slide feature on the same subject also was supplied to 200 stations. Five other photo stories, prepared by ARS, graphically illustrating an aspect of the USDA pest control program were also issued. (I) Washington, D. C.

State Slides and Films. The State Extension Services have developed and/or purchased films and slides on safe and proper use of pesticides for their own needs. An example illustrative of this cooperative endeavor was the New York State Extension Service's purchase of some \$5,500 of film produced by the Kansas State Extension Service. Also, in cooperative agreements with the Department (FES), the New York and Minnesota Extension Services produced several films they have made available to other States on a cost-share basis. Films produced included the 4-1/2-minute consumer-directed film on Safe Use of Pesticides by New York, and the two 15-minute films, Use of Pesticides in the Home Garden (which won an ACE Association of College Editors award), and a farm-directed one for leaders on Controlling Pesticides, by Minnesota. (I) and (E) Washington, D. C., State Extension Services.

Extension Color Visuals. The Department (FES) and the Cooperative State Extension Services in Georgia, Indiana and South Carolina are cooperating in the development of a weed publication, a series of color pest identification sheets, and color slides. States will be provided with two sets of the color slides and up to two thousand copies of the color weed publication and color identification sheets with the provision that additional supplies can be procured on a cost-share basis. (I) and (E) Washington, D. C., and States indicated.

Exhibits

Registration, Monitoring. The Department's pesticide registration and monitoring programs were dramatized to the public through exhibits at the Agriculture/2000 Science in the Service of Man Open House (ARS) at Beltsville, Maryland. The USDA pesticide policy exhibit and the exhibit of the Federal

Committee on Pest Control, built by the Department, were displayed at a number of national meetings of education, business, and industry groups during the year. Plant quarantine exhibits were seen at fairs and airports. (I) Washington, D. C.

Safety in the Home. Several consumer-directed exhibits on poison prevention in the home and pesticide safety were developed by the State Extension Services. Many of these have been displayed at county and State fairs. Some of these exhibits have also become a permanent part of district Extension office resources and are maintained for county and local use. New Jersey, in cooperation with FES, developed a Poisons in Your Home exhibit with kit. The kit consists of two pamphlets on poisons in the home, directions for constructing the exhibit, and a slide set with script. The exhibit and kit have been made available for national use. (I) and (E) Washington, D. C., and New Jersey, other State Extension Services.

Pesticides Information Centers

Pesticides Documentation Bulletin. Through a computer-based system, a total of 31,964 references to worldwide literature on pesticides and pest control were indexed and published in the biweekly indexing journal, Pesticides Documentation Bulletin. Approval has been granted by the Bureau of the Budget to continue publication of this Bulletin through March 1968. (I) Washington, D.C.

Index Contract. The Pesticides Information Center began indexing English Language literature on all aspects of pest control dating between 1960 and 1966 under a contract with International Information, Inc., Philadelphia, Pennsylvania. The contract called for magnetic tape files containing 19,500 periodical articles selected by the Center to be indexed by the contractor. (I) and (E) Washington, D. C.

Herbicides Information. The Pesticides Information Center, in cooperation with the Crops Protection Research Branch, ARS, Beltsville, Maryland, initiated a contract with Control Data Corporation, Rockville, Maryland, to provide data files on magnetic tape for approximately 5,000 herbicide compounds which have been tested at Beltsville since 1952. (I) and (E) Washington, D. C., Contractor, Rockville, Maryland.

State Extension Chemical Information Centers. As part of the expanded effort to provide the public with the latest pesticides safety information, Centers were established in the 50 States, Puerto Rico, the Virgin Islands, and the Ryukyu Islands. These Centers, headed by the State Extension Chemical Coordinators, received over 96,652 pieces of literature from the Office of the

Federal Extension Service Coordinator, Agricultural Chemicals Program. The literature distributed included information on laws, regulations, registered uses and cancellations, residue tolerances, safety precautions, application and safety equipment, safe and proper storage, handling, and use of pesticides. The Centers also received bulk shipments of pesticide chemicals publications from the Department. (I) and (E) Washington, D. C., State Extension Services.

Coordination and Liaison

In order to accomplish its mission in the field of pesticide usage and pesticide-related activities, the Department continued to expand coordination and liaison with other agencies and departments of the Federal and State governments through the Federal Committee on Pest Control; the three-way agreement with the Departments of Interior, and Health Education, and Welfare for clearance of pesticide registration application and the establishment of residue tolerance levels; and other arrangements to facilitate cooperative action and the exchange of information among all concerned.

The Department also strengthened its liaison and collaboration with educational institutions, industry and business organizations, citizens groups, and foreign governments concerned with the safe, effective use of pesticides and the development of new methods of pest control.

Federal Committee on Pest Control. The Department continued to give full support--scientific, technical, and financial--to the activities of the FCPC and its subcommittees in the evaluation and coordination of all pest control programs involving Federal agencies and funds. Established by the Secretaries of Agriculture, Interior, Defense, and Health, Education and Welfare, the committee and its subcommittees include nearly 30 members and alternates from USDA agencies.

Major activities during 1967 were:

Parent Committee. Adopted charter revisions which broadened FCPC responsibilities for advising on U. S. pest control operations in foreign countries, for cooperation with State and local groups on pest control problems, and for formulating general pest control guidelines. Gave special attention to spruce budworm control project as requested by the State of Maine. Approved a USDA proposal to establish a new subcommittee to deal with problems involving packaging, storage, transportation, marketing, and disposal of pesticides. (I) Washington, D. C.

Program Review Subcommittee. Reviewed and approved all 45 pest control programs submitted by USDA, along with dozens of programs submitted by other Departments and agencies. This subcommittee was chaired by a Department representative in 1967. Both the Subcommittee and the parent committee evaluated each program on the basis of (1) expected benefits, (2) effectiveness, (3) safety, and (4) adverse effects to man and his environment before deciding for or against approval. (I) Washington, D. C.

Information Subcommittee. This Department assisted in the preparation of the 17-page booklet, Federal Committee on Pest Control... What It Is, What It Does, fully underwriting production costs, and issuing 27,000 copies through its facilities. The Department arranged for display of the FCPC exhibit at a number of national meetings. Its representatives on the subcommittee are participating in the planning and implementation of a proposed two-part national pesticides information survey, the first part of which--on improved pesticide labeling--is being undertaken by ARS. (I) Washington, D. C.

Research Subcommittee. Completed tabulation of those Federally-financed research programs involving pesticides and pest control. Intensive study is being given to each category of research to determine (1) the adequacy of the research effort, and (2) whether or not duplication exists between Departments. Active participation by USDA specialists on this Subcommittee has been beneficial to the Department and to the nationwide effort to safely control pests. (I) Washington, D. C.

Monitoring Subcommittee. The USDA National Soils Monitoring Program is a part of the National Pesticides Monitoring Program established by the FCPC. The Department's program underwent major revision with approximately 15,000 sample sites selected across the nation for monitoring purposes. The Subcommittee prepared a catalog of Pesticide Monitoring Activities with the first issue due to appear shortly. The Department contributed a number of articles to the Pesticide Monitoring Journal issued under Subcommittee auspices. (I) Washington, D. C.

Departmental Pesticides Committee. Services in the Department of Agriculture engaged in pesticides and related activities participate in a USDA-wide coordinating and planning committee. The committee meets regularly to review USDA and cooperative programs, discuss and evaluate current developments and develop recommendations about Department policies. USDA

representatives to the Federal Committee on Pest Control and its subcommittees provide liaison with the Departmental Pesticides Committee.

Departmental Weed Committee. Several USDA Services are represented on this committee to review and evaluate Department and cooperative programs and to further internal communication and planning. Representatives of this committee also participate in two interagency weed committees.

Interagency Committee on Use of Herbicides in Aquatic Sites. USDA representatives are working with representatives of the Bureau of Reclamation, Bureau of Land Management, Bureau of Sport Fisheries and Wildlife, U. S. Army Corps of Engineers, Tennessee Valley Authority, Public Health Service, Food and Drug Administration, and Federal Water Pollution Control Administration and Office of Ecology of the Department of the Interior. The Committee is reviewing the regulatory status of herbicide usage in and around aquatic sites and in developing information with a view to the registration of those herbicides deemed essential in continuing weed control programs authorized by Congress or essential to the mission of the different Federal agencies.

Interagency Committee on Preventive Weed Control. Agencies represented on this Committee, in addition to USDA, include: Bureau of Indian Affairs, Bureau of Land Management, U. S. Army Corps of Engineers, Bureau of Sport Fisheries and Wildlife, and Department of Health, Education, and Welfare. Objectives of the Committee are:

1. Evaluate the adequacy of State and Federal legislative authority to (a) prevent the importation of weeds and their propagation parts, (b) regulate the domestic movements of weeds, and (c) quarantine and eradicate weed infestations.
2. Recommend research, education and regulatory programs and other ways and means of increasing the effectiveness of preventive methods of weed control.

Information Coordination. With expansion of the USDA pest control information program into the schools and other areas, the Office of Information intensified coordination of pesticides information activities both inside and outside the Department. It worked closely with the Agricultural Research Service, Forest Service, Federal Extension Service, Soil Conservation Service, Consumer and Marketing Service, National Agricultural Library, and other concerned agencies, as well as with and through the Departmental Pesticides Committee. Working relationships with State agencies and private organizations were expanded to include State and local educators, National Science

Teachers Association, American Pharmaceutical Association, Newspaper Enterprise Association, and national television networks. Cooperation continued with the National Pest Control Association, National Agricultural Chemicals Association, National Safety Council, Cooperative Extension Service, and other groups. (I) Washington, D. C.

Extension Service Liaison. The Federal Extension Service maintained almost daily liaison and cooperation on pesticides programs with national and State government agencies, organizations and groups such as the agricultural chemicals associations, safety councils, cotton councils, canners associations, pest control associations, aerial applicators associations, wildlife organizations, and professional organizations such as the Entomological Society of America, American Phytopathological Society, Weed Science Society of America. Another phase of the expanded liaison effort has been the role of Extension in gathering and disseminating information on problem situations related to pesticide usage, accidents and safety. (I) Washington, D. C.

United States-European Meeting on Pesticide Residue Regulations. In December, 1967, representatives of the United States, Belgium, the Netherlands and the Federal Republic of Germany met in Bonn, Germany. The regulation of pesticides and the possible impact upon the consumer safety and the environment were among the items discussed. The discussions revealed that actual pesticide residues are comparably low in all countries. Residue tolerances are established on the basis of possible impact on health. No significant differences were apparent in the legal, administrative and enforcement standards and procedures. Additional conferences were planned to provide closer cooperation among nations and additional information on the safety of the food supplies.

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E X A M P L E S O F C H A N G E S
I N T H E P R O G R A M

The pesticide and pesticide related activities of the Department of Agriculture undergo constant review. These activities are never static but are continually adjusted to take advantage of new discoveries and to shift resources to where they can be best utilized. The fluid state of the activities can be illustrated by the following examples of lines of work initiated and terminated during 1967.

General

Initiated

Pest control by environmental manipulation and the restoration of natural biotic systems. (E-fg) California Agr. Exp. Sta.

Cytogenetic taxonomy of Kochia seoparia, Sonchus arvensis, S. oleraceus, Hordeum jubatum, and Taeniatherum asperum, and their ecotypes. (E) North Dakota State University.

Genetics and evolution of pathogenic and reproductive mechanisms in *Helminthosporum*. (E-fg) Pennsylvania Agr. Exp. Sta.

Movement of insecticides from agricultural watersheds in the Blacklands of Texas. (E) College Station and Riesel, Texas.

Remote sensing technique as a detection method for imported fire ant. (I) Weslaco, Texas.

Movement of chlorinated hydrocarbon insecticides in the vapor phase in soil. (I) Riverside, California.

Effects of pesticides and other chemical contaminants on microbial processes in soils. (I) Beltsville, Maryland.

Movement of herbicides in soil, surface water, and underground water. (E) Bushland, Texas.

Biosystematics of scale insects of the genus Melanaspis in North America. (E) University of Maryland.

Taxonomy and hosts of the ichneumonid genera Phobocampe and Olesicampe. (E) Amer. Entomol. Inst.

Taxonomy and biology of immature stages of the moth family Arctiidae. (E) Florida Agr. Exp. Sta.

Bionomics of the alfalfa weevil. (E-fg) Indiana Agr. Exp. Sta.

Synthesis of possible chemosterilants. (E) University of Pennsylvania.

Taxonomy and biology of immature stages of the moth genus Acrobasis. (E) North Carolina State University.

Pesticidal plants. (E) National Botanical Garden, Luchnow, India.

Physiology of the insect nervous system. (E-fg) Pennsylvania Agr. Exp. Sta.

Role of quinones in regulating populations of the confused flour beetle in foods and feeds. (E) Cornell University.

Study of sound receptors in stored-product insects. (I) Savannah, Georgia.

Identification of bacteria occurring in the alimentary canal of the granary weevil and the lesser meal worm. (E) University of Minnesota.

Controlled atmosphere to protect stored products against insect damage. (I) Savannah, Georgia.

Determination of the role of parasites and predators in eliminating populations of the Indian-meal moth. (E) Clemson University.

Preparation of long-chain unsaturated alcohols and their derivatives for test as insect sex attractants. (E) Howard University.

Biosystematics of the western United States seed weevils. (E) Northern Arizona University.

Biology of virus transmitting leafhopper species. (E) Oregon State University.

- Taxonomy and systematics of aquatic insects. (E) Oregon State University.
- Synthesis of fluorescent insecticides and their reaction with enzyme systems. (E) University of Georgia.
- Influence of environment on the response of plants to herbicides. (E-fg) Washington Agr. Exp. Sta.
- Physiology of seedling development and vegetative reproduction of poison ivy and mugwort. (E) Virginia Polytechnic Institute.
- Weed life cycles as related to weed control in the Northeast. (E-fg) New York Agr. Exp. Sta.
- Life history and control studies for Johnsongrass. (E-fg) Illinois Agr. Exp. Sta.
- Tissue culture evaluation of herbicides for the control of perennial weeds and brush. (E-fg) New Mexico Agr. Exp. Sta.
- Biochemistry of host-plant preference in Agasicles sp. (Coleoptera: Chrysomelidae) to alligatorweed. (E) Stanford Research Institute.
- Principles of designing integrated control systems. (I) Columbia, Missouri.
- Evaluation of plant extracts and synthetic chemicals as attractants for the white-fringed beetle. (E) University of Georgia.
- Engineering technology as related to the application of agricultural chemicals. (E-fg) Alabama Agr. Exp. Sta.
- Radio aircraft guidance for aerial application of insecticide. (I) Hyattsville, Maryland.
- Feasibility of low volume application of insecticides for control of cotton insects. (E-fg) Mississippi Agr. Exp. Sta.
- Determination of factors governing downward translocation and root exudation. (E) Carver Research Foundation.
- Reduction of hazards associated with the presence of residues of insecticidal chemicals in the environment. (E-fg) Iowa Agr. Exp. Sta.

Effect of soil fumigants on nutrient composition, eating and consumer use qualities of carrots, celery, lima beans, and oranges. (E) University of California.

Encapsulation as a technique in the formulation of insecticide and viruses for control of insects. (E) Nat. Cash Reg.

Methods development for detection, identification, and quantitation of herbicides and their metabolites in plant cells and tissues. (E) University of Missouri.

Microscopic studies of mode of action of nematocides. (E) Auburn University.

Studies on the mode of action of nematocides. (E) University of California, Riverside.

Depression of blood cholinesterase activity by organophosphate compounds in domestic animals. (E-fg) Florida Agr. Exp. Sta.

The desposition of pesticides in the soil. (E-fg) Florida Agr. Exp. Sta.

Absorption, translocation, and metabolism of herbicides by crop and weed species. (E-fg) Mississippi Agr. Exp. Sta.

Insecticide uptake by plants. (E-fg) Wisconsin Agr. Exp. Sta.

Mechanisms of insecticidal action. (E-fg) New York Agr. Exp. Sta.

Methods for increasing or decreasing herbicidal persistence in plants, soils, and water. (E) Battelle-Northwest, Richland, Washington.

Study of herbicide selectivity using intra-species plant indicators. (E-fg) Illinois Agr. Exp. Sta.

Investigations of herbicides in water and crops irrigated with water containing herbicides. (E) Stanford Research Institute.

Methods and equipment for the decontamination and disposal of herbicides and containers. (E) Mississippi State University.

Role of peptide hydrolases in herbicide metabolism by plants. (E) North Dakota State University.

Movement of herbicides off, into, and through soils. (E) North Carolina Agricultural Experiment Station.

Terminated

Influence of soil organics on insecticide adsorption and reaction. (I) Fort Collins, Colorado.

Biology and control of animal pests affecting cultivated mushrooms. (E-fg) Pennsylvania Agr. Exp. Sta.

Bionomics of the Indian-meal moth in limited environments. (E) Clemson University.

Identification of Nearctic species of Trogoderma females. (E) California Department of Agriculture.

Leaching characteristics of certain herbicides in selected soils. (E-fg) Florida Agr. Exp. Sta.

Physiology and biochemistry of nematode and nematode host relationships. (E-fg) Delaware Agr. Exp. Sta.

The effect of fungus products on arthropods. (E-fg) Indiana Agr. Exp. Sta.

Natural attractant studies with the black carpet beetle. (E) Stanford Research Institute.

Control of noxious perennial weeds by chemical and cultural methods. (E-fg) Georgia Agr. Exp. Sta.

Investigations of the microorganisms which attack Oulema species in Europe and the propagation and release of European insect parasites of Oulema species in Indiana. (E) Purdue University.

Development of new chemicals for use as insecticides, fungicides, bactericides, and herbicides. (E-fg) Pennsylvania Agr. Exp. Sta.

Role of dealers in informing consumers about characteristics and uses of pesticides. (E-fg) Alabama Agr. Exp. Sta.

Investigation of methods for controlling certain insects and mites affecting greenhouse ornamental and vegetable crops. (E-fg) Pennsylvania Agr. Exp. Sta.

Develop simple, rapid methods and a field kit for the qualitative detection of pesticide residues. (E) Midwest Research Institute.

Communications pattern among rural Wisconsin residents on several aspects of pesticide use. (E-fg) Wisconsin Agr. Exp. Sta.

Effects of pesticide residues on feed and forage fed to livestock. (E-fg) Iowa Agr. Exp. Sta.

Study of insecticides, with special reference to factors governing effectiveness such as physical characteristics, weather, and distribution over plants. (E-fg) Mississippi Agr. Exp. Sta.

Use of chemicals for weed control and defoliation of crop plants. (E-fg) Georgia Agr. Exp. Sta.

Creosotebush control with hormone type herbicides. (E-fg) New Mexico Agr. Exp. Sta.

Herbicidal brush and weed control for range development and pasture improvement. (E-fg) Arkansas Agr. Exp. Sta.

Shrub invasion forage production inter-relations on Arizona rangelands. (E-fg) Arizona Agr. Exp. Sta.

Perennial weed control related to crop production in eastern Washington. (E-fg) Washington Agr. Exp. Sta.

Control of pathogens causing diseases of legumes and grains. (E-fg) Delaware Agr. Exp. Sta.

Interrelationships between soil insecticides and soil micro-organisms. (E-fg) Wisconsin Agr. Exp. Sta.

Mechanisms and extent of pesticide adsorption by soil and soil colloidal components. (E-fg) Wisconsin Agr. Exp. Sta.

Fate of herbicides in Coastal Plain and Piedmont soils as influenced by fertilization and liming practices. (E-fg) South Carolina Agr. Exp. Sta.

Animals

Initiated

Explore the phenomenon of thiabendazole resistance in strains of helminthic parasites of sheep and other livestock. (I) Beltsville, Maryland.

Taxonomic revision of the North American species of the biting midge genus Forcipomyia. (E) University of Maryland.

Biology and ecology of lesser meal worm to find new control procedures for preventing transmission of leukosis to chickens. (E) University of Maryland.

Survey of the bacteria of parasitic helminths preliminary to studying:
(1) Bacterial diseases of helminths; (2) transmission of disease agents;
(3) relationship of hyper-parasites to animal hosts. (I) Beltsville, Maryland.

Metabolic waste products in the feces of infected animals will be examined to determine effects of residues of various diets on the bionomics of developing eggs and larvae of nematode parasites. (I) Experiment, Georgia.

Development of antibiotic resistance in enteric microorganisms in chickens and swine. (E) Batelle Memorial Institute.

Develop better residual insecticide treatments for dairy-product storage and processing facilities. (E) University of Wisconsin.

Research that will apply engineering and physical sciences to obtaining basic data on biophysical instrumentation and environmental effects for use in studies of animal and insect toxicology and biophysical responses of organisms to chemicals. (I) College Station, Texas.

Studies with greater emphasis on fungicidal compounds. (I) Kerrville, Texas.

Initiation of triple-labeled chemical elements utilizing three of four radio-isotopes to more easily and readily detect residues of the parent compound and any of its breakdown products in pesticide-exposed animals. (I) Kerrville, Texas.

Site of absorption and fate of dermally and orally applied pesticides.
(I) Beltsville, Maryland.

Toxicity studies of defoliants, growth regulators, nematocides, fumigants, repellents, and other miscellaneous agricultural chemical compounds. (I) Kerrville, Texas.

Studies on recently developed chemosterilant compounds. (I) Kerrville, Texas.

Histopathologic examination of tissue specimens from animals fatally affected from pesticide exposure(s). (I) Kerrville, Texas.

Radiotelemetry in collecting physiologic and pathologic data on unrestrained animals exposed to pesticides. (I) Kerrville, Texas.

Relationships between Melophagus ovinus, the sheep ked, and "cockle" of sheepskin. (I) Albuquerque, New Mexico.

Quantitative measurement of the fate of organic phosphate insecticides in beef cattle. (I) Beltsville, Maryland.

Importance of feed as an unavoidable source of pesticide contamination in poultry meat and eggs. (E) Wooster, Ohio.

Effect of ingested malathion and methoxychlor in sheep on the possible presence of residues in milk, wool and body tissue. (I) Beltsville, Maryland.

Terminated

Studies of species of thread-necked strongyles, Nematodirus, of domestic sheep in the United States and the parasites of Rocky Mountain bighorn sheep in North America. (I) Beltsville, Maryland.

Improved procedures for direct microscopic counting of bacteria in milk. (I) Beltsville, Maryland.

Selective action of 2, 4-D as related to tissue composition and differential tumor formation in Convolvulus arvensis. (E-fg) New Mexico Agr. Exp. Sta.

Effects of organic phosphate systemic insecticides on embryonic survival and development in the bovine. (E) Nebraska and Montana.

Feed additives in poultry feeds. (I) Glendale, Arizona.

Physical and chemical factors affecting sorption and retention of quaternary ammonium compounds by wool. (E) Harris Research Laboratories.

Feed additives in fur animal diets. (I) Petersburg, Alaska.

Field Crops

Initiated

Evaluating the quality of gamma-irradiated grains and cereal products. (I) Beltsville, Maryland.

Role of stored-product insects in distributing potentially hazardous micro-organisms and their byproducts in stored grains. (E) Kansas State University.

Germination inhibitors in bunt teliospores. (E) and (I) Oregon Agr. Exp. Sta.

Breeding and nature of resistance in alfalfa to lygus and the seed chalcid. (E-fg) New Mexico Agr. Exp. Sta.

Bionomics of the alfalfa weevil in Wisconsin. (E-fg) Wisconsin Agr. Exp. Sta.

Physical and chemical nature of soil in relation to the biology and reproduction of nematodes attacking soybeans. (E) Iowa State University.

The role of insects as vectors of peanut stunt virus. (E) North Carolina State University.

Influence of certain plant hormones and their balance on diapause of Heliothis zea and H. virescens. (E) University of Arkansas.

Chemical mutagenesis of tobacco mosaic virus. (E-fg) Missouri Agr. Exp. Sta.

Effects of sorghum varieties on the development of two species of rice weevils. (E) California State College of Los Angeles.

Imported parasite for cereal leaf beetle. (I) Niles, Michigan; (E) Purdue University, Michigan State University.

Screening small grains for resistance to leaf rust, powdery mildew, soil-borne mosaic and other major diseases. (E-fg) Georgia Agr. Exp. Sta.

Biological control methods for the cereal leaf beetle. (E) Indiana Agr. Exp. Sta.

Anaphes sp. for the control of the cereal leaf beetle. (E) Michigan Agr. Exp. Sta.

Biology, life history, and propagation methods for parasites, especially Tetrastichus julis of the cereal leaf beetle. (E) Purdue University.

Plant resistance to insects and mites associated with viral and toxicogenic diseases of corn. (E) Ohio Agr. Res. & Dev. Center.

Field trials for evaluation of sorghum strains to charcoal rot. (E) Arizona Agr. Exp. Sta.

Biology of Verticillium albo-atrum. (I) College Station, Texas.

Sterile weevil technique studied as eradication method for boll weevil. (I) Presidio, Texas.

Mechanical and biochemical nature of resistance in cotton to the root-knot nematode. (E) University of Arizona, Tucson.

Development of sugarbeet germ plasm resistant to yellows viruses and/or aphid vectors of these viruses. (E) Washington State University.

Development of weed control practices adaptable to the production of grain and forage crops. (E-fg) Georgia Agr. Exp. Sta.

Fate of malathion residues on grain sorghums. (E) Kansas State University.

Causes, effects, and control of diseases of oilseed crops in Arizona. (E-fg) Arizona Agr. Exp. Sta.

Investigations of herbicides for weed control in soybeans and their interactions with other practices. (E-fg) Georgia Agr. Exp. Sta.

Biology and control of the sunflower moth. (E) Texas A&M University.

Number and size of spray droplets deposited on target insects as influenced by the type and density of foliage. (E) University of Georgia.

Integrated cotton insect control. (E-fg) New Mexico Agr. Exp. Sta.

Development of weed control practices to increase yields, to improve quality and to further mechanization in cotton. (E-fg) Georgia Agr. Exp. Sta.

Control methods for sugarbeet root maggot. (E) North Dakota State University.

Role of Fusarium spp. as crown and root pathogens of forage legumes. (E-fg) Pennsylvania Agr. Exp. Sta.

Terminated

Behavior of cereal leaf beetle as affected by climatic factors. (E) Purdue University.

Effect of environment and nutrition on the development of rice diseases. (I) Stuttgart, Arkansas; and Biggs, California.

Biology and control of the cowpea curculio and other cowpea insects. (E-fg) Mississippi Agr. Exp. Sta.

Cheatgrass control and range reseeding. (I) Twin Falls, Idaho.

Nature of bacterial blight mutation. (I) Stillwater, Oklahoma.

Bionomics of boll weevil and bollworm populations as related to cotton insect control practices. (E) Mississippi State University.

Infrared rice dryers for insect control. (I) Fresno, California.

Techniques for evaluating grain sorghum for resistance to charcoal rot. (E) Arizona Agr. Exp. Sta.

Breeding bacterial blight resistant cotton varieties. (I) Marianna, Arkansas.

Flowing steam under vacuum to control stored-tobacco insects. (I) Richmond, Virginia.

Investigation of the tobacco hornworm sex attractant. (E) University of Wisconsin.

Growth and development of Lygus spp. as influenced by cotton plant nutrition. (E-fg) New Mexico Agr. Exp. Sta.

Horticultural Crops

Initiated

Nature, diagnosis, spread, and control of stubborn diseases of citrus. (E-fg) California Agr. Exp. Sta.

Physiology and cytology of virus infection. (E-fg) California Agr. Exp. Sta.

Determining the morphological and taxonomic characters of immature stages of Carpophilus beetles. (E) California Department of Agriculture.

Bacterial diseases of beans. (E-fg) Idaho Agr. Exp. Sta.

Biology and control of arthropod pests of woody ornamental plants in Alabama. (E-fg) Alabama Agr. Exp. Sta.

Suppression of populations of orchard mites with pesticide resistant predators. Part I. Selection of promising predators for rearing. (E) Pennsylvania Agr. Exp. Sta.

Reduction of molds on canteloups. (I) Harlingen, Texas.

Bacterial soft rot of peppers. (I) Harlingen, Texas.

Integrated control of insect and mite pests of apple orchards. (E) Ohio Agr. Res. & Dev. Center.

Heat treatment of figs. (I) Fresno, California.

Cause, nature and control of diseases of Arizona vegetable crops. (E-fg) Arizona Agr. Exp. Sta.

Bacterial diseases of beans. (E-fg) Hawaii Agr. Exp. Sta.

Epiphytotic development and control of diseases of pome and stone fruits. (E-fg) Alabama Agr. Exp. Sta.

Determination of costs and benefits of presently recommended control practices for combating red scale on citrus as compared with minimizing the sum of treatment costs plus yield loss over a period of time by the use of simulation procedures. (E) Davis, California.

Biology, ecology, and control of Anastrepha suspensa. (E) University of Florida.

Terminated

Ozone treatment of fruits for disease control. (I) Beltsville, Maryland.

Value of control measures for the pecan nut casebearer Acrobasis caryalgrate and the hickory shuckworm Laspeyresis caryana (Fitch). (E-fg) Mississippi Agr. Exp. Sta.

Evaluation of herbicides for selected horticultural crops. (E-fg) Alabama Agr. Exp. Sta.

Forests

Initiated

Large-scale detection survey for introduced Formosan subterranean termite. (I) and (E) Southern, Western and Eastern States.

Development of x-ray techniques to estimate populations of pine beetles in standing lodgepole pine. (I) Ogden, Utah.

Detection by remote sensing of changes in tree vigor under various conditions of stress from diseases and insects. (I) Berkeley, California.

Epidemiology of Cronartium comandrae. III Ecology of comandra. (I) Logan, Utah.

Compounds in mature pine needles which inhibit the germination of teliospores and basidiospores of Cronartium fusiforme. (I) Asheville, North Carolina.

Transmission of western x-virus in choke cherry. (I) Lincoln, Nebraska.

Epiphytology of needle cast fungi. (E) Colorado State University.

Charting air movements with smoke to indicate fungus spore paths. (I) St. Paul, Minnesota.

Biology and ecology of fir needleminer. (I) Berkeley, California.

Microbial and mycorrhizal factors inhibiting pathogenic root fungi in red-alder--conifer associations of the Douglas-fir regions. (I) Corvallis, Oregon.

Biological control of white pine blister rust. (E) Washington State University.

Field testing bark beetle sex attractants. (I) Berkeley, California.

Sterile male technique tested against gypsy moth in Pennsylvania and New York. (I) Cape Cod, Massachusetts.

Control of Comandra rust in lodgepole pine with antibiotics. (I) Moscow, Idaho.

Control of the Formosan subterranean termite. (I) Gulfport, Mississippi.

Pathogenicity and mode of action of non-crystalliferous aerobic bacteria in gypsy moth and other forest insect larvae. (I) New Haven, Connecticut.

Terminated

White pine provenance study of weevil resistance. (I) New Haven, Connecticut.

Open vs. closed wounds and progress of decay. (I) Stoneville, Mississippi.

Symmetrical - Dichlorotetrafluoroacetone: A possible chemotherapeutant for control of fusiform rust. (I) Gulfport, Mississippi.

Inter-fertility tests to confirm the identity of the brown rot species Polyporus meliae. (I) Laurel, Maryland.

Biology and control of the Great Basin tent caterpillar. (I) Albuquerque, New Mexico.

Biology and behavior of the Douglas-fir tussock moth. (I) Portland, Oregon.

Assessment of native parasites and predators of European pine shoot moth in western Washington. (I) Portland, Oregon.

Chemosterilization of the spruce budworm by treatment of the male pupae. (I) St. Paul, Minnesota.

Biological evaluation of Bidrin for Dutch elm disease control. (I) Delaware, Ohio.

UNITED STATES DEPARTMENT OF JUSTICE FEDERAL BUREAU OF INVESTIGATION

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APPENDIX

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Table 1. PARTICIPATING USDA SERVICES AND AGENCIES
Pesticides and Related Activities

Organizational Unit	Activity						
	R e s e a r c h	E d u c a t i o n	I n f o r m a t i o n	R e g u l a t i o n	C o n t r o l	M o n i t o r i n g	
Agricultural Research Service							
Agricultural Engineering Research	X						
Animal Disease and Parasite Research	X						
Animal Husbandry Research	X						
Animal Health					X		
Crops Research	X						
Entomology Research	X						
Human Nutrition Research	X						
Information			X				
Market Quality Research	X						
Pesticides Regulation				X			
Plant Pest Control					X	X	
Plant Quarantine					X		
Soil and Water Conservation Research	X						
Agricultural Stabilization and Conservation Service	X						
Cooperative State Research Service	X						
Forest Service							
Forest Pest Control					X		
Forest Protection Research	X						
Information and Education		X	X				
Timber Management Research	X						
Watershed, Recreation & Range Res.	X						
Federal Extension Service		X					
Economic Research Service	X						
Consumer and Marketing Service							
Livestock Slaughter Inspection						X	
Processed Meat Inspection						X	
Technical Services						X	
National Agricultural Library		X					
Office of Information			X				
Office of the General Counsel				X			
Research Program Development and Evaluation Staff	X						

Table 2 (Part A). FUNDS AVAILABLE FOR PESTICIDE AND RELATED ACTIVITIES
 United States Department of Agriculture
 Totals by Agency for Fiscal Years 1967, 1968, and 1969 Estimated
 (Thousands of Dollars)

Agency	1967			1968			1969		
	Program	Facilities	Total	Program	Facilities	Total	Program	Facilities	Total
Agricultural Research Service	82,261	1,653	83,914*	82,594	2,762	85,356*			85,575*
Agricultural Stabilization and Conservation Service	28	-	28	29	-	29			19
Cooperative State Research Service	9,409	2,063	11,472	8,977	150	9,127			9,274
Consumer and Marketing Service	535	-	535	639	-	639			732
Economic Research Service	511	-	511	512	-	512			517
Federal Extension Service	4,360	-	4,360	4,400	-	4,400			4,400
Forest Service	18,184	857	19,041	16,118	477	16,595			16,333
National Agricultural Library	333	-	333	295	-	295			295
Office of Information	79	-	79*	58	-	58*			68*
Research Program Development and Evaluation Staff	15	-	15*	15	-	15*			15*
TOTAL	115,715	4,573	120,288	113,637	3,389	117,026			117,228

* Includes resources drawn from a \$250,000 intra- and interdepartmental pesticide coordination fund first appropriated to the Department in Fiscal Year 1965

Table 2 (Part B) FUNDS AVAILABLE FOR PESTICIDE AND RELATED ACTIVITIES
 United States Department of Agriculture
 Totals by Target for Fiscal Years 1967, 1968, and 1969 Estimated
 (Exclusive of New Facilities)
 (Thousands of Dollars)

TARGETS	1967	1968	1969 Estimated
1. Fundamental Biology	16,307	16,013	16,052
2. Improved Means of Nonpesticidal Control	23,702	22,779	24,576
3. Improved Pesticide Use Patterns	12,937	11,618	11,957
4. Toxicology, Pathology, Metabolism & Fate	4,942	5,480	5,663
5. Economics of Pest Control, Use, Supply, and Requirements	655	651	648
6. Pest Control	47,973	47,392	48,007
7. Monitoring	1,121	1,291	1,390
8. Regulation	3,284	3,645	3,937
9. Information, Education & Coordination	4,787	4,768	4,778
TOTAL	115,708	113,637	117,008

Table 2 (Cont'd.)
 (Part B)

Table 2 (Part C). FUNDS AVAILABLE FOR PESTICIDE AND RELATED FACILITIES
 United States Department of Agriculture
 Totals by Agency for Fiscal Years 1967 and 1968
 (Thousands of dollars)

Agency and Facility	Fiscal Year 1967	Fiscal Year 1968
<u>Agricultural Research Service:</u>		
Cereal rust laboratory, St. Paul, Minnesota (Total cost - \$650,000 including \$50,000 planning funds provided in F.Y. 1966)	\$600	-
Grain marketing research laboratory, Manhattan, Kansas (1/3 of laboratory relates to pesticide research) Total cost pesticide related including \$75,000 provided for planning funds in F.Y. 1966 - \$1,128,000)	1,053	-
Facilities for control of plant diseases, nematodes and insects, Beltsville, Maryland (Total cost - \$3,225,000 including \$338,000 planning funds provided in F.Y. 1965) Planning funds for Grassland Restoration Laboratory at Temple, Texas (approximately 80% of laboratory relates to pesticides research) (Total cost pesticides related - \$1,440,000)	-	2,500
Planning additional facilities for horticultural research on ornamentals at Corvallis, Oregon, and Puyallup, Washington (approximately 80% of laboratory relates to pesticide research) (Total cost pesticides related - \$215,000)	-	120
Modernization of tobacco research laboratory at Oxford, North Carolina (Total cost - \$150,000) (Approximately 80% relates to pesticides research)	-	20
	-	120

Agency and Facility	Fiscal Year 1967	Fiscal Year 1968
Planning funds for enlarging the Soil and Water Research Station at Orono, Maine (Total cost pesticides related - \$22,500) (Approximately 5% of laboratory relates to pesticides research)	-	2
TOTAL, ARS Research Facilities	\$1,653	2,762
<u>Cooperative State Research Service</u>		
Grants to State Agricultural Experiment Stations	2,063	150
TOTAL, Cooperative State Research Facilities	2,063	150
<u>Forest Service</u>		
Asheville, North Carolina, greenhouse		10
Athens, Georgia, Construction, Forestry Science Laboratory	390	225
Corvallis, Oregon, design and specifications, Forestry Science Laboratory	170	-
Delaware, Ohio, design and specifications, Insect and Disease Laboratory	72	83
Olympia, Washington, construction, Silviculture and Animal Problems Laboratory	225	-
Durham, New Hampshire, design and specifications, Forestry Science Laboratory	-	15
Hamden, Connecticut, construction, Forest Insect and Disease Laboratory	-	111
Moscow, Idaho, design and specifications, Forestry Science Laboratory	-	33
TOTAL, Forest Service	857	477

Table 2 (Cont'd)
(Part C Cont'd)

Table 3. CODE SCHEME

-- COMMODITY/IES OR RESOURCE/S --

Code No.	Subject	Code No.	Subject
1.	<u>General</u>	35.	Fibers
2.	<u>Animals</u>	351.	Cotton
		352.	Others
21.	General	36.	Tobacco
22.	Beef		
23.	Dairy	37.	Sugar
24.	Poultry	371.	Sugarcane
25.	Swine	372.	Sugar beets
26.	Sheep	373.	Others
27.	Horses		
28.	Others	38.	Other
3.	<u>Field Crops</u>	4.	<u>Horticultural Crops</u>
31.	General	41.	General
32.	Cereals	42.	Vegetables
321.	Wheat	421.	Potatoes
322.	Barley	422.	Tomatoes
323.	Oats	423.	Onions
324.	Rice	424.	Beans
325.	Rye	425.	Peas
326.	Corn	426.	Root Vegetables
327.	Sorghum	427.	Leafy Vegetables
328.	Others	428.	Curcurbits
		429.	Others
33.	Forage		
331.	Grasses	43.	Deciduous Fruits
332.	Alfalfa	431.	Peaches
333.	Clover	432.	Plums
334.	Range	433.	Apples
335.	Turf	434.	Apricots
336.	Others	435.	Pears
		436.	Cherries
		437.	Others
34.	Oilseeds		
341.	Soybeans	44.	Citrus Fruits
342.	Flax	441.	Oranges
343.	Safflower	442.	Grapefruit
344.	Peanuts	443.	Lemons
345.	Cottonseed	444.	Others
346.	Others		

Table 3. (Cont'd)

Code No.	Subject	Code No.	Subject
<u>Horticultural Crops</u> (Cont'd)			
45	Small Fruits	47.	Nuts
451.	Grapes	471.	Pecans
452.	Berries	472.	Walnuts
453.	Others	473.	Almonds
		474.	Filberts
46.	Ornamentals	475.	Others
461.	Flowers		
462.	Shrubs	48.	Others
463.	Trees		
464.	Others		
		5.	<u>Forests</u>

-- PESTS --

Code	Subject
A.	<u>General</u>
B.	<u>Diseases</u>
C.	<u>Insects</u>
D.	<u>Weeds</u>
E.	<u>Parasites</u>
F.	<u>Nematodes</u>
G.	<u>Others</u>



Use Pesticides Safely
FOLLOW THE LABEL

U.S. DEPARTMENT OF AGRICULTURE

a SB951

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RESERVE

✓
1968

REPORT ON PESTICIDES AND RELATED ACTIVITIES

- **Research**
- **Education**
- **Information**
- **Regulation**
- **Control**
- **Monitoring**

For

**Assuring adequate supplies of
wholesome, economic food and
fiber**

**Managing the environment for the
long range good of man**

301562

NOV 1968

1968 PROGRESS REPORT

ON

PESTICIDES

AND

RELATED ACTIVITIES

U.S. Department of Agriculture
and ~~Cooperators~~

This report has been prepared in limited numbers. Persons having a special interest in the development of public pesticide and related programs may request copies from the Research Program Development and Evaluation Staff, Room 331-E, Administration Building, USDA, Washington, D.C. 20250

*** **

N A T U R E O F P R O G R A M

The Department of Agriculture conducts, and otherwise supports, a comprehensive, forward looking in-depth program involving (1) pesticides and (2) related activities, the result or objective of which is pest control without using toxic chemicals or with only limited amounts of them. This report documents the general nature and objectives of this program and cites examples of specific activities and progress.

Pesticides are defined as economic poisons including (1) any substance or mixture of substances intended for preventing, destroying, repelling or mitigating any insects, rodents, nematodes, fungi, weeds, and other forms of plant or animal life or viruses, except viruses on or in living man or animals, which the Secretary of Agriculture shall declare to be a pest, and (2) any substance or mixture of substances intended for use as a plant regulator, defoliant or dessicant.

Related activities involve such things as (1) developing crop varieties and trees that are resistant to attack by specific insects or diseases, (2) controlling certain economic pests by identifying, propagating and distributing predators or parasites specifically attacking those pests, (3) introducing pests with modified biological characteristics into natural populations in order to reduce or eliminate the pest by disrupting reproduction and (4) preventing the introduction of dangerous foreign pests.

Frequently the control of a pest involves both pesticidal and nonpesticidal methods. This "integrated control" approach is an inherent part of much of the work described in this report.

Numerous components of the Department of Agriculture have major programs dealing with pesticides and related activities. These components are listed in Table 1 in the Appendix, together with indications of the general types of activities with which they are involved.

The Department was one of the original sponsors of the Federal Committee on Pest Control. It participates actively in its work, including extensive membership within its several subcommittees. In addition, USDA scientists

share in leadership and other membership participation in an Interdepartmental Weed Committee. The Department supported the establishment of Pesticide Coordinating Committees in each State. USDA employees regularly consult with these groups about policy and program matters as requested.

Close informal relationships are maintained with such industry and public organizations as the National Agricultural Chemicals Association, Manufacturing Chemists Association, Chemical Specialties Manufacturing Association, National Cannery Association, National Pest Control Association, Wildlife Management Institute, and the National Safety Council. These contacts include frequent exchange of information and distributional materials.

Department leaders in pesticides and related activities are working with the Food and Agriculture and the World Health Organizations of the United Nations. They also participate in the pesticide activities of the Organization for Economic and Cooperative Development, the United States-Japanese Cooperative Program sponsored by the National Science Foundation and the Codex Alimentarius Commission, which establishes international standards for food products.

Funds appropriated to the Department of Agriculture that were allocated to pesticides and related activities for fiscal years 1968 and 1969 and those estimated for 1970 are tabulated in Table 2 in the Appendix.

Many USDA employees are directly engaged in pesticides and pesticides-related activities. This is referred to as intramural work and is coded by "(I)" at the end of paragraphs on succeeding pages in this report describing activities and progress. Paragraphs describing USDA cost-sharing with farm, ranch, and woodland operators for pest control under the Agriculture Conservation Program are coded "(I-cs)". The Department also supports work done entirely by other public and private agencies through contracts, grants, and cooperative agreements. This extramural work is coded by "(E)". Major grant funds are also extended to State Agricultural Experiment Stations and Schools of Forestry through formula grant procedures authorized by the Hatch and McIntire-Stennis Acts. Paragraphs citing research supported in part by these funds are coded "(E-fg)".

The largest number of the paragraphs in this report describing activities and progress are accompanied by number-letter codes. Numbers refer to categories of commodities or resources and letters refer to types of pests. The scheme on which the codes are based is included in Table 3 in the Appendix.

The program of the Department of Agriculture is firmly based on research. Knowledge gained through research and action programs is applied in education, information, regulation, pest control, and monitoring activities. The pesticide and pesticide-related efforts of the Department are presented in this report under nine Targets shown on page ii. Examples of the kinds of work under each of the Targets are presented in the next few paragraphs.

Target I - Fundamental biology. Studies of the taxonomy, biology, ecology, physiology, pathology, metabolism and nutrition of pests and host plants and animals.

Includes such research as:

1. Understanding and manipulating diapause in insects.
2. Discovering responses of pests and hosts to light intensity, duration and wave length.
3. Prevention of fertilization of pests.
4. Maintaining standards of reference and identification of pests and their hosts.
5. Understanding relationships among competing parasites.
6. Relation of microbes to pesticide degradation.
7. Development of media for artificially rearing pests.
8. Understanding host-parasite relationships.

Target II - Improved means of nonpesticidal control. Control of pests by nonpesticidal means is an ultimate goal. Progress is being made through pest-resistant crops and trees; pest attractants and repellents; release of predators, parasites, and pathogens for specific pests; and physical, cultural, and mechanical control practices.

Includes such research as:

1. Utilizing germ plasm collections in breeding for disease and insect resistance and other useful characteristics.
2. Identifying and extracting naturally occurring attractants and repellents.
3. Controlling pests with parasites and predators.
4. Controlling pests through improved cultural practices.
5. Controlling animal diseases by vaccination.
6. Developing artificial atmospheres for controlling pests of stored commodities.

Target III - Improved pesticide use patterns. New knowledge about present and potential pesticides is sought to develop safer and more effective use patterns, better formulations, and more efficient application methods. Procedures are developed for detecting and measuring the pesticides and metabolites and for eliminating or minimizing residues.

Includes such research as:

1. Fumigating stored products, both in storage and in transit with nonresidual pesticides.
2. Insectproofing of packing materials and fabrics with newer nontoxic compounds.
3. Increasing the accuracy of application of pesticides.
4. Reducing the amounts of pesticides applied.
5. Eliminating or reducing damage of pesticides to plants, animals and wildlife.
6. Finding of promising replacements for persistent pesticides.

Target IV - Toxicology, pathology, metabolism and fate of pesticides. New knowledge is sought about toxicological and pathological effects of pesticides and their metabolites--applied or fed to laboratory and farm animals, or applied to crops. Information is also developed about levels of residues and their metabolic pathways in plants, animals, and their products and in other parts of the environment and about ways to avoid them or deal with them.

Includes such research as:

1. Determining the metabolism of pesticides.
2. Measuring the persistence and distribution of pesticides in the environment.
3. Screening of pesticides for gross toxicology and pathology in animals.
4. Detoxifying pesticides.
5. Determining the storage of residues in plant and animal tissues and products.
6. Evaluating the impact of pest control on the environment.

Target V - Economics of pest control, and use, supply, and requirements of pesticides. Determinations are made of the economics of pest control, of where and what pesticides are used, and of the supply and demand of pesticides.

Includes such reasearch as:

1. Estimating nationwide use of pesticides.
2. Ascertaining the demand for pesticides, both nationally and internationally.

Target VI - Pest control and protection of the environment during and after control operations. Where necessary, local, State or Federal agencies conduct area pest control programs. Cost-sharing for pest control is a part of agricultural conservation programs. Technical assistance is provided at various regional, State, and local levels for persons or groups participating in these and other programs. In addition, steps are taken to exclude dangerous foreign pests from this country. In conducting direct pest control programs and in providing technical assistance and cost-sharing guidelines are adhered to or are strongly recommended to limit or avoid possible side-effects of pesticide applications. These include controlling kinds and amounts of chemicals used, frequency of applications, and areas treated; operating only under favorable weather conditions; and taking special precautions to protect operators, animals, bees, and so on.

Includes such actions as:

1. Eradicating certain economic pests.
2. Detecting and treating new infestations to prevent buildups in populations of destructive pests.
3. Halting or minimizing the threat of spread of important economic pests.
4. Intercepting thousands of pests at point of entry.
5. Discovering and controlling pest species new to the United States.

Target VII - Monitoring. The presence and distribution of pesticides are systematically measured in agricultural raw materials and food and in the environment.

Includes such monitoring as:

1. Soil and water in selected areas of high, moderate, and no pesticide usage.

2. Samples of domestic and imported meats.
3. Samples of several root crops.

Target VIII - Regulation. The Department of Agriculture is responsible, by law, for the Federal Insecticide, Fungicide, and Rodenticide Act. Compliance with this Act is required to assure properly labeled pesticides with guidelines for their safe and effective use.

Includes such actions as:

1. Registering an increasing number of products.
2. Surveying products for compliance.
3. Participating in the development of interdepartmental procedures for registration.
4. Reevaluating registrations on basis of current information.

Target IX - Information, education, and coordination. Results of research and facts about control efforts are transmitted through information and education activities. Constant emphasis is placed on safe and effective use of pesticides. A review of the voluminous literature on pesticides is regularly published. USDA programs are coordinated, not only within the Department but also with other Federal, State, and private organizations.

Includes such actions as:

1. Producing and distributing television and radio spot announcements on using pesticides safely.
2. Developing motion pictures on the need for pesticides and their safe use.
3. Operating a computer-based information retrieval system.
4. Distributing educational materials to schools on a nationwide basis.
5. Conducting training meetings and schools on safe and effective pesticide usage.
6. Fostering and participating in intra- and interdepartmental coordination.

CODES

Most of the paragraphs describing activities and progress of pesticides and related activities end with codes and information about the location of the work:

Arrangements for Expending USDA Appropriated Funds

- I = Intramural: Work conducted by USDA employees
- I = Intramural--cost sharing; Assistance provided by USDA for pest control in connection Agriculture Conservation Programs
- E = Extramural: Work conducted by other than USDA employees through contracts, grants, cooperative agreements, or cooperative aid from USDA agencies conducting research or action programs
- E-fg = Extramural--formula grants; Work conducted by State Agricultural Experiment Stations and/or Forestry Schools through grants distributed on a formula basis under the terms of the Hatch and McIntire-Stennis Acts.

Nature of Work--Commodity or Resource/s--Pests

The code scheme involving a Roman numeral, an Arabic number and a letter designation is described in Table 3 in the Appendix.

*** *** ***

E X A M P L E S O F
E N V I R O N M E N T A L C O N S I D E R A T I O N S

In addition to the pests that they are intended to control, pesticides may affect various aspects of the environment. Appropriately, there is concern about the distribution and effects of pesticides in or on soil, water, air, and the myriad life forms.

The activities described in this report are in keeping with the USDA Policy on Pesticides 1/ that says in part:

"In protecting man, animals, plants, farm and forest products, communities and households against depredation of pests, the Department has vital concern for (1) the health and well-being of people who use pesticides and those who use products protected by their use; and (2) for the protection of fish, wildlife, soil, air and water from pesticide pollution."

"In keeping with this concern, it is the policy of the Department of Agriculture to practice and to encourage the use of those means of effective pest control which provide the least potential hazard to man and animals. When residual pesticides must be used to control or eliminate pests, they shall be used in minimal effective amounts, applied precisely to the infested area and at minimal effective frequency. Biological, ecological or cultural methods or nonpersistent and low toxicity pesticides will be used whenever such means are feasible and will safely and effectively control or eliminate target pests."

"Further, the USDA will urge that all users of pesticides exercise constant vigilance to assure the protection of human health by avoiding unnecessary exposure of crops, livestock, fish and wildlife."

1/ Secretary's Memorandum No. 1565, December 23, 1964

While the thrust of USDA pesticides and related activities is "..... to make continuing progress in the never-ending struggle to protect man, his food and fiber supplies, and his forests from the ravages of pests.", these activities are conducted within the framework of a deep seated concern about environmental considerations. The Department's policy on Enhancing the Quality of the Environment 2/ says in part:

"..... Environment describes the living conditions for people. Other forms of life that share the earth are a part of that environment. Enhancing the quality of man's environment in harmony with the productive use of our physical, biological, social, and economic resources is of direct concern to and is a major responsibility of the United States Department of Agriculture."

"In fulfilling its responsibilities, the Department shall conduct its activities in a manner that enhances the quality of our total environment. To carry out this over-all commitment, the Department will intensify research, regulation, education, and action programs into a total systems approach to carry out environmental objectives."

The concern of the Department as expressed in these policy statements is illustrated by some selected paragraphs.

REDUCTION OF USE OF PESTICIDES OR OF THEIR EFFECTS ON THE ENVIRONMENT

Methods of Application

Distribution of solid materials from aircraft. Trajectories of granular particles released from an aircraft show that wingtip vortices exert a significant influence only on the path of small particles less than 500 micron diameter, provided that the particles are released at a point on the wing outside the core region of the tip vortex. A computer program was modified to compare experimental trajectory and theoretical wingtip vortex data to develop empirical relationships. A theoretical analysis of the mechanics of solid particles dispersed from aircraft by pneumatic spreaders yielded equations which are being verified by simulated tests. Valid equations will facilitate improved design of application equipment. (E)
Mississippi Agr. Exp. Sta.

III-1-A

2/ Secretary's Memorandum No. 1631, March 19, 1968.

Herbicide application equipment. Equipment was developed to apply herbicides as a foam. A stream of high-velocity air is mixed with a stream of liquid from a flat fan spray nozzle and directed through rubberized pig hair to produce relatively drift-free foam. A tractor mounted plot sprayer was developed for testing large numbers of post emergence chemicals for weed control. Tests using water and dye showed little or no contamination occurring when chemicals are changed. Several types of hose pumps were tested to determine metering accuracies. The liquid flow from these pumps is in the form of solid streams or large droplets and the flow rate is proportional to ground speed. Atomizing air streams at the end of the hoses are proposed for producing spray patterns. (I) Stoneville, Mississippi. III-31-D

Ultralow-volume application of defoliant. Experimental applications of full strength defoliant formulations in the range of 2-4 pints per acre appear to be yielding satisfactory results. The development of this method, if continued testing proves satisfactory, will greatly decrease handling time and labor involved in ground machine and air defoliant applications. (I) Stoneville, Mississippi; Shafter, California. III-351-G

Low-volume application of Malathion effective against Larch Casebearer. The application of eight fluid ounces (0.6 lb. actual) per acre of technical grade malathion to control the larch casebearer effected 96 percent reduction, as compared with nearly 100 percent control with the "standard" treatment of 1/2 lb. malathion in one gallon fuel oil per acre. This test was conducted in the northern Rocky Mountains, where three-fourths of the larch stands now are infested by this insect. (I) Moscow, Idaho. III-5-C

Biological Controls

Breeding of Plants for Resistance or Tolerance to Pests

Hessian fly populations on wheat controlled by resistant cultivars. During the past 20 years 24 Hessian fly resistant wheat cultivars have been released to farmers. These cultivars are now grown on more than ten million acres in 34 States. Although there are insecticides approved for Hessian fly control, their use has not been required. Since resistant wheats almost entirely prevent reproduction of certain strains of Hessian fly, the total area-wide population of the fly is reduced as the percentage of resistant wheat acreage increases and fly damage to susceptible wheats is reduced. Seven strains of Hessian fly have been identified, and none of the released cultivars are resistant to all strains. However, germ plasm which resists all known Hessian fly strains is available. (I) Lafayette, Ind.; and Manhattan, Kans. (Coop. State and Federal wheat breeders) II-321-C

Aphid resistant alfalfas reduce insecticide usage. The spotted alfalfa aphid, first found in the United States in 1954, spread into 33 States within five years. Since 1956 ten spotted alfalfa aphid resistant cultivars have been released and are now grown on more than half the acreage in a 12-State area most susceptible to damage. Since the spotted alfalfa aphid reproduces from

five to six times faster on susceptible than on resistant cultivars the overall spotted alfalfa aphid population has been materially reduced. Biological agents such as parasites and predators have contributed to additional population reductions. Due to these environmental management activities, insecticides are rarely needed for control of the insect in this area. (I) Tucson and Mesa, Ariz.; Lincoln, Nebr. (Coop. State and Federal Alfalfa Breeders and Entomologists)

II-332-C

Virus yellows resistant sugarbeet. The first American variety of sugarbeet with tolerance to virus yellows has been officially released as US H9. The variety is only moderately resistant to the virus complex, but the level of protection is sufficient to remove the major need for pesticides. (I) Salinas, Calif.

II-372-B

Multigenic late blight resistance and multiple disease resistance in potato. Over 450 potato lines were screened for resistance to Races 1, 2, 3, and 4 of the late blight pathogen. Many selections were highly resistant to late blight in the field. One selection (B6038-1) has late blight resistance combined with resistance to scab, Verticillium wilt, net necrosis, stem-end browning, and mild mosaic. (I) Orono and Presque Isle, Maine; and Morgantown, W. Va.

II-421-B

Breeding disease resistant peas. Greenhouse and field tests were used to evaluate pea breeding material for resistance to enation mosaic virus, the pea streak virus complex, powdery mildew, wilt, near wilt, and root rot. The selection program was continued and advanced materials increased for larger trials. Previously increased lines were evaluated in drill trials on the research farm and by cooperators in many areas. Several of these lines may be selected for further increase and possible release. (E-fg) Oregon Agr. Exp. Sta.

II-425-B

Parasites and Predators

Parasites of the southern pine beetle. In east Texas, 26 species of hymenopterous parasites have been found associated with the southern pine beetle. Nine are confirmed parasites of this beetle and Ips engraver beetles. Because they are generally sparse, occur irregularly during the year, and are not host-specific, most of these parasites are not effective in reducing beetle populations. Roptocerus xylophagorum, Dendrosoter sulcatus, Heydenia unica, and Coeloides pissodes seem to have the best potential for use in biological control because of the synchronization of their life cycles with that of the southern pine beetle and associated Ips and their relative abundance. (I) Alexandria, Louisiana.

II-1-C

Pathogens. Thirty-five pathogenic micro-organisms, including viruses, bacteria, protozoa, and nematodes, have been isolated from stored-product insects. Thirty of these are highly virulent to insects. Certain microsporidian pathogens are relatively host-specific, readily transmitted, and

capable of causing high mortality. A new genus and three new species of nematodes have been isolated from dried-fruit beetles. These are new host records. The nematodes sterilize adult female beetles and produce high mortality. (I) Savannah, Ga. II-1-C

Insects to control alligatorweed. Additional releases of the alligatorweed flea beetle were made this year throughout southeastern United States (except Louisiana), and in Texas and California. This Argentine beetle Agasicles n. sp. has been released each year since 1965 as a biological control agent for alligatorweed. So spectacular has the performance of this beetle been in clearing waterways of this weed in Florida, that the plans of the U.S. Corps of Engineers to chemically treat 2,200 acres of waterways in that State in 1968 were cancelled. Over 15,000 adults and immatures of the newly described thrips, Amynothrips andersoni, from Argentina were liberated in South Carolina, Florida, Georgia, Mississippi, and California. A third Argentine alligatorweed enemy, the phycitid moth Vogtia malloi, is currently undergoing feeding and host plant specificity tests preliminary to its release. (I) Albany, Calif. II-1-D

Biological control of pear psylla. Studies on the pear psylla, Psylla pyrocola, revealed this pest to have been adequately controlled through the activity of predators and parasites. Mortality of the pear psylla was measured during the winter months through pear harvest in October. It is believed that biological control has the potential to replace chemical methods of control for this pest. (E-fg) Oregon Agr. Exp. Sta. II-435-C

Efforts in nonchemical control of Dutch elm disease. Naturally-occurring bacteria and fungi flushed from healthy elms by centrifugation were tested for potential antagonism to Ceratocystis ulmi in plate culture. Three bacterial isolates inhibited the fungus, but cell-free filtrates did not. The data suggest possibility of antagonism in vivo that might prevent initial infection. Observation of development of Dutch elm disease under both chronic and acute gamma radiation and fungus spore survival following acute radiation was continued. Inoculated-irradiated trees were less subject to disease than inoculated but nonirradiated controls, but not significantly. (E-fg) Maine Agr. Exp. Sta. II-5-B

Sterility

Population suppression of cabbage looper over three generations affected by a single release of partially sterile irradiated males under laboratory conditions. Laboratory data demonstrate the effectiveness of releasing partially sterile irradiated male cabbage loopers for population control. This method has several advantages over releasing completely sterile males: (1) one release of partially sterile males will have a suppressive effect over three generations since the progeny of these irradiated males exhibit various degrees of sterility in later generations whereas the effect of the sterile male is for only one generation; (2) the partially sterile males are

more competitive and fewer insects need to be released; and (3) because of the high cost of mass-rearing Lepidoptera, immediate savings in the cost of a program will be realized. (I) Fargo, N.D. II-427-C

Equipment for aerial release of sterile male insects. Equipment was developed and tested for metering and dispensing sterile male codling moths from a helicopter. Powered by a variable-speed electric motor, this device also partially opens the cardboard containers as it dispenses them. Turbulence of the air under the helicopter completes the opening of the box, allowing the insects to spill out after initial deceleration of the container. (I) Forest Grove, Oregon. II-433-C

Sterility technique replaces chemicals in Mexican fruit fly control. More than 23,000,000 sterilized Mexican fruit flies were released during 1967 in Tijuana, Ensenada, and Tecate, Baja California, Mexico. This field application of the sterile technique has eliminated chemical control in those areas and has been successful in protecting California and Arizona citrus from attacks by this serious pest. (I) Mexico. VI-44-C

Attractants and Repellants

Alfalfa weevil arrestant isolated from alfalfa. Extracts from alfalfa using either a 1:1 acetone - distilled water mixture or distilled water alone elicited an attractant or arrestant response from the alfalfa weevil. Both extracts were deactivated by heat or when left overnight in an uncovered dish at 3 to 5° C. When stored at this temperature in a covered container, activity was retained for 12 to 15 days. (E) Blacksburg, Va. I-332-C

Sweetclover weevil feeding deterrent identified. A feeding deterrent in sweetclover which appears to be primarily responsible for the resistance to the sweetclover weevil has been isolated in pure crystalline form. It has been identified by physical and chemical methods as ammonium nitrate. (E) Lincoln, Nebr. I-333-C

Sugarbeet wireworm sex attractant identified. Beltsville chemists of USDA, cooperating with scientists of the Canada Department of Agriculture have identified valeric acid as the sex attractant produced by female sugarbeet wireworms, Limonius californicus. Although this is chemically the simplest natural sex attractant yet discovered, its identification was made from only 18 insects. (I & E) Beltsville, Md.; and Canada. I-372-C

Coneworm adults respond to host tree stimulants. Detailed electrophysiological studies of the responses of coneworm adults to extracts from slash pine conelets showed strongest reactions to α -pinene and d-limonene. Ethanol extracts gave more marked responses than those utilizing methylene chloride, benzene, chloroform, and ether. Chloroform and carbon tetrachloride extracts of cone material elicited strong responses, also. (I) Raleigh-Durham, N.C. 1-5-C

Traps baited with virgin female lesser peach tree borer moths highly attractive to males. Marked laboratory-reared males were released in the center of the 45-acre experimental peach orchard to determine the efficiency of 60 sticky traps, each baited with six virgin females. A total of 3,206 marked males were made between May 27 and July 28, 1967. Recaptures ranged from 69 to 92%, with an average of 82%. A total of 4,987 marked males were released different distances from the Patoka peach orchard during the period June 7-September 15. Recoveries for each release point were: 1/4 mi. - 47%, 1/2 mi. - 43%, 3/4 mi. - 22%, 1 mi. - 22%, 1-1/2 mi. - 17%, 2 mi. - 15%, 3 mi. - 4%, and 4 mi. - 6%. One marked male was captured in each of two traps nine and ten miles from the release point. (I) Vincennes, Ind.

II-431-C

Bark beetle responds to synthetic sex attractant. The first flight response of a bark beetle to a synthetic replicate of its natural sex attractant under field conditions was reported by a team of scientists from the Forest Service, University of California, and Stanford Research Institute. The synthetic material was a mixture of three terpene alcohols isolated originally from frass of the insect, the California five-spined engraver. Two insect predators of this bark beetle also responded strongly to the attractant. Synthetic production of this and other bark beetle attractants will facilitate large scale use of them in surveys and, perhaps, for mass trapping as a control measure. (I) Berkeley, California, and (E) University of California and Stanford Research Institute.

II-5-C

Cultural and Mechanical Controls

Electric equipment for insect control. The possibility of reducing insecticidal contamination of the environment through use of electric equipment for insect control has received considerable research effort. For example, near Oxford, North Carolina, use of electric traps having one blacklight lamp at a density of three traps per square mile for control of tobacco hornworm throughout a 300-square-mile area has resulted in 27 percent and 65 percent less insecticide use by tobacco growers within the area in 1965 and 1966, respectively, as compared to growers outside the area. Similarly, use of an integrated insect-control program, including systemic insecticide, light traps, the pathogen Bacillus thuringiensis, and treatments of relatively nonpersistent insecticides as needed, has reduced the total number of insecticide applications on cigar wrapper tobacco grown near Quincy, Florida, 80 percent, 76 percent, and 43 percent in 1965, 1966, and 1967, respectively. Also, use of light traps at a density of one trap per four trees in an isolated pecan grove near Sasser, Georgia, permitted production of a nut crop without significant damage from hickory shuckworm using insecticide applications only for early-season control of aphids. (I)

II-1-C

Nematode control in grain-peanut rotations. In a two-year study in Georgia, growing rye before peanuts greatly reduced injury caused by lesion nematodes (Pratylenchus brachyurus) when compared with growing oats or wheat, or use

of a clean fallow, before peanuts. These data confirm that the reason rye, preceding peanuts, is a superior rotation to oats or wheat is because of the susceptibility of these grains to nematodes. (I) Tifton, Georgia.

II-344-F

Mechanical destruction of boll weevil. Reduction in insecticide requirements for cotton is the goal of developers of a flail-type machine for destroying boll weevil in fallen cotton squares. This machine, mounted on a tractor, picks up cotton squares from the ground and chops them into small pieces. Tests have shown that weekly trips through a field with the machine provide adequate early-season control of boll weevil infestations. (I) State College, Mississippi.

II-351-C

Atmosphere modification. Continuing research to reduce the need for post-harvest chemical treatments confirms that reduced oxygen concentrations (1 to 2% for tolerant commodities) or increased carbon dioxide (20 to 25% for tolerant commodities) have distinctly inhibiting effects on postharvest decay development. The application of such modified atmospheres during storage and transport can reduce or eliminate the need for chemical treatment. (I) Fresno, California.

II-41-B

Selective thinning of host trees may regulate jack-pine budworm populations. After hatching in late summer and following emergence from hibernation in the spring, many small larvae fall to the ground or are carried off by the wind. Losses in the spring are greatest, sometimes ten times those in the summer dispersal period, and highest larval mortality occurs in the more open stands (30 square feet of basal area per acre or less). Selective thinning to reduce the stocking of host trees thus may maintain population densities of the insect at low levels. (I) St. Paul, Minnesota.

II-5-C

Pesticide Wastes

Disposal of waste pesticides and containers. In response to concern over pollution hazards to man, to livestock, and to wildlife, research was initiated (1) to determine the degradation requirements of pesticide chemicals by thermal, chemical, biological or other means; (2) to determine the requirements for pesticide containers that can be safely disposed of; and (3) to develop specifications for equipment and facilities proposed for safe disposal of waste pesticides and their containers. (E) Mississippi Agri. Exp. Sta.

IV-1-A

INTERACTIONS BETWEEN PESTICIDES AND THE ENVIRONMENT

Plants

Amiben metabolism in plants. The metabolism of amiben to an N-glucoside by several plant species and tissues together with the effect of light and darkness on this pathway were determined at Fargo, North Dakota. An enzyme from soybean which is responsible for the biosynthesis of N-glucosides was partially

purified and characterized. The absorption and translocation of endrin after root and leaf surface application was determined. The metabolism of monuron and diuron by leaf discs of several plant species was demonstrated. The inhibition of urea herbicide metabolism by insecticidal carbamates was also shown. A biological assay system was developed to follow herbicidal urea metabolism in isolated leaf discs. Several metabolites of CIPC in soybean were isolated and partly characterized. (I) Fargo, North Dakota. IV-1-A

Pesticide metabolism in barley. Absorption and translocation studies have been made with the insecticide MCA-600 and the fungicide D-735 in barley. The major metabolites of the insecticide MCA-600 in barley have been isolated and partly identified. A whole plant radiorespirometer system has been developed for following the metabolism of one pesticide in the presence of another. Gas chromatographic procedures for the determination of chloroanilines and tetrachloroazobenzene have been developed. (I) Fargo, North Dakota. IV-1-A

Soils

Adsorption of pesticides by clays. Paraquat was added to montmorillonite and vermiculite in amounts up to the adsorption capacity of the clay. The clay plus paraquat was subsequently added to cups of sand in which cucumber test plants were grown. Montmorillonite provided protection against the paraquat to the extent that at up to 90% saturation no plants were killed by the end of ten days, while the check (no clay) showed complete kill after two days. The vermiculite provided no protection other than a slight retarding of availability of paraquat to the plants. Malathion was adsorbed by Na, Ca, Al, and La montmorillonite to a maximum of 1 millimole per milliequivalent of clay CEC. Infrared studies indicated that the mechanisms of adsorption included ion-dipole bonding between the exchangeable cation of the clay and the carbonyl oxygen of the Malathion. (E-fg) N.C. Agr. Exp. Sta. IV-1-A

Adsorption of pesticides in soils. In studying the adsorption of amitrole and prometone, adsorption was found to be influenced by soil acidity. Under mildly acid conditions, the retention by organic matter is more important than that by clay. (I) Beltsville, Md. IV-1-D

Inactivation of herbicides in soils. Atrazine, simazine, prometryne, and 2,4-D labeled with C^{14} were applied to soil samples initially or after one or two prior applications on non-labeled herbicide. The rate of decomposition of 2,4-D was increased by previous treatment with 2,4-D but no such response was obtained with the triazines. Repeated applications decomposed at essentially the same rates as initial applications. Low availability of triazine carbon and lack of microbial response indicates that degradation is passive, incidental to metabolism of soil organic matter. Inactivation of atrazine and diuron was measured in the field at three locations. Inactivation was related to concentration of each herbicide in the soils in a manner approximating a first-order reaction. The half-life of atrazine ranged from 30 to 36 days and that of diuron from 58 to 128 days in these soils. Both of these herbicides were found to have mobility by leaching to the depth of the plow layer. (E-fg) Ala. Agr. Exp. Sta. IV-1-D

Climatic and soil factors influencing herbicide activity and persistence.

The initial and residual toxicities of atrazine, ametryne, prometryne, and diuron in 13 different soil types found in Puerto Rico have been studied under greenhouse conditions. The results of studies on initial toxicity indicated that ED(50) values of the above mentioned herbicides varied greatly with different soil types. In simple correlation analyses, ED(50) values of the four herbicides were positively correlated with organic matter content of the soil and with cation exchange capacity, exchangeable calcium and exchangeable magnesium. Multiple and partial correlation analyses verified that organic matter was the determinant factor with respect to the initial toxicity of herbicides. The lack of correlation between ED(50) values of herbicides and percent of clay suggested that clay content has a minor effect on herbicide performance. (E-fg) Puerto Rico Agr. Exp. Sta. IV-1-D

Soil type affects the toxicity and selectivity of pre-emergence soil herbicides. Fourteen of the major Colorado agricultural soils have been collected in relatively large quantities. Analysis of all major physical characteristics and some of the biological characteristics have been determined. Tests of the fate of two major soil applied herbicides, dicamba and picloram, applied to the above 14 soils under controlled moisture and temperature conditions are in progress. A detailed test of the effect of temperature, when moisture is not limiting, has nearly been completed for the behavior of pyrazon, a widely used soil herbicide in sugar beets. (E-fg) Colorado Agr. Exp. Sta. IV-1-D

Atmosphere

Loss of pesticides by volatilization. Volatilization has been suspected as a major source of unaccountable losses of pesticides in experimental work. Recent studies show this to be a major pathway for some chlorinated hydrocarbons such as dieldrin, DDT, and lindane. Results show rate of vaporization to be dependent upon temperature, soil water content, and the concentration in the water surface. It is not related to the amount of water evaporated. The nature of the soil colloid, mineral or organic, also influences the degree of volatilization. (I) Riverside, Calif.; and Fort Collins, Colo.

IV-1-C

Degradation of pesticides by light. Of interest to scientists and the general public is the persistence of pesticide compounds once they accumulate in the soil. In order to obtain some information on time of persistence, degradation products and methods of decontamination, a series of studies have been initiated in the Division. In a study at Fort Collins, Colorado, DDT exposed to intense ultraviolet light degrades to a number of products. DDE, DDD, DDC=O, DDOH, DDA, and BA have been identified, and three other products have been isolated but not identified. (I) Fort Collins, Colo.

IV-1-C

Animals

Gastrointestinal absorption of carbamates in animals. Absorption studies with the carbamate pesticides, Mobam, Baygon, Carbaryl, Zectran, and Barban, have been conducted with duodenal and ileal isolated intestinal loops

established in swine. Initial observations suggest that the absorption mechanism of the carbamates differs from that of glucose. The inclusion of polyethylene glycol in the perfusion solution to solubilize the carbamates appeared to decrease the rate of absorption by about one-third of that observed with physiological saline solutions. Absorption tests with Mobam and Baygon suggest that the rate of absorption from the Thiry-Vella loop of the ileum is slower than that from a Thiry-Vella loop of duodenum. Evidence has been obtained in these absorption tests to indicate that the carbamates are degraded in varying degrees during the course of the perfusions. (I) Fargo, North Dakota.

I-21-A

Metabolic fate of estrous-control chemicals in swine. The nonsteroid compound (MATCH-ICI 33,828), an estrous-control chemical in animals--especially useful in swine, was synthesized with a C¹⁴ label. Rats and swine were dosed with this preparation to study its metabolic fate. Approximately 0.5% of the radioactivity was recovered in the respired CO₂. Gilts excreted 93.5% (70% in 48 hours) in the urine and 5.5% in the feces over an eight-day collection period. Approximately 30% of the radioactivity in the urine was present as the thiodiazole and the thiodiazole and the parent compound. Work is in progress on the isolation and identification of the water-soluble metabolites. MATCH appears to be rapidly degraded and excreted by the animal body. (I) Fargo, North Dakota.

I-21-A

Insects

Metabolism of DDT in mosquitoes. DDT and its metabolic products have been determined by gas chromatography in mosquito larvae treated at 15° and 30°C. Although larvae are affected by lower doses at the cooler temperature, the amount of C¹⁴ labelled DDT increased with increasing temperatures. Current research utilizes quantitative comparisons of DDT and its metabolites, particularly DDE and TDE using gas chromatography. Early experiments show no significant differences between DDT and DDE but quantities of TDE have not been finally determined. Different rates of formation of the metabolites may provide an explanation for the negative temperature coefficient. (E-fg) Minnesota Agr. Exp. Sta.

IV-21-C

Fate of hempa in house flies. In vivo studies of the metabolism of the insect chemosterilant hempa (hexamethylphosphoric triamide) in house flies have shown that demethylation is the most important deactivating step. It was shown that the demethylation is an enzymatic process performed by insect microsomes. Microsomal preparations from carbamate-resistant and susceptible strains of house flies metabolized hempa to the same products as obtained in vivo. (I) Beltsville, Md.

IV-21-C

Metabolites of insect chemosterilant hemel. The metabolism of the insect chemosterilant hemel (hexamethylmelamine) in male house flies was investigated. Four metabolites were detected in the flies and their feces. More active as a sterilant than any of these is N,N,N',N'-tetramethylmelamine, which was not detected as a metabolite but has been synthesized. The metabolic pattern of hemel has a marked similarity to that of hempa. (I) Beltsville, Md.

IV-21-C

Micro-organisms

Herbicides alter biochemical reactions of soil bacteria. Microrespirometer studies indicated that the enzyme, fumarase, of bacteria was particularly sensitive to 2,4-D. Enzyme studies with crude cellular extracts again indicated the extreme sensitivity of fumarase to 2,4-D. By enzyme purification and other biochemical studies it became apparent that 2,4-D inhibited fumarase only if adenylic acid (AMP) was also present. AMP alone at relatively high concentrations will inhibit fumarase. However, at low concentrations of AMP, 2,4-D is required to exhibit the inhibition. It appears that 2,4-D potentiates the inhibitory effector action of AMP on fumarase. Indole acetic acid, a natural plant auxin, is ten times as effective as 2,4-D. The evidence indicates that plant auxins and their analogues act by potentiating the effector activity of nucleotides. (E-fg) La. Agr. Exp. Sta. IV-1-A

Soil micro-organisms metabolize organic arsenical herbicides. In work at Beltsville, Maryland, four soil micro-organisms isolated in pure culture degraded MSMA-C¹⁴ to C¹⁴O₂ and arsenate in liquid culture solutions. Breakdown of MSMA in soils is slow, since only 2-10% of the labeled carbon was released from soils after 60 days. (I) Beltsville, Maryland. IV-1-A

Microbial degradation of pesticides. Two degradation products of DDT are DDD and DDE. Both of these were found to be fairly stable in soils under both aerobic and anaerobic incubation conditions. A spore-forming, gram-positive bacillus was isolated from a soil amended with DDT. In thioglycollate medium, this organism converted 27 percent of DDT present to DDD in nine days. Other studies with dalpon showed that breakdown in five soils was not related to the total population of bacteria capable of this breakdown. (I) Fort Collins, Colorado; and Beltsville, Md. IV-1-C,D

Interactions between herbicides and soil micro-organisms. In three different soils treated with the herbicides Diquat and Paraquat at field rates, and at two to ten times these recommended rates, ammonification and sulfur oxidation were slightly depressed in a silty clay loam but were increased in silt loams. Nitrification was stimulated by the lowest rate; the higher rates have little influence. Each chemical caused some decrease in soil respiration. Four of six species of bacteria tested could use the herbicides as sole sources of nitrogen and carbon. Analytical recovery of Paraquat from the different soils was correlated with soil type, specifically with cation exchange capacity, amount and kind of clay, and organic matter content. (E-fg) Ore. Agr. Exp. Sta. IV-1-D

Nitrification affected by herbicides. The herbicides Diuron, Picloram, Ametryne, and Prometryne were applied at rates ranging from 1 to 100 ppm to several soils and incubated at field capacity at 24°C. Nitrification of 100 ppm applied ammonium nitrogen was studied for eight weeks. The effect of the herbicides on the nitrifying organisms largely depended on soil types. Ametryne and Prometryne applied at usual rates did not affect nitrification. Picloram and Diuron even at 2 ppm inhibited nitrification in some soils.

Ametryne applied at 100 ppm resulted in nitrite accumulation in certain soils, indicating inhibition of the Nitrobacter bacteria. Diuron increased bacterial growth, reduced the actinomycetes and was ineffective to fungi. Picloram also increased bacterial growth, reduced the actinomycetes, and increased the fungi. (E-fg) Puerto Rico Agr. Exp. Sta. IV-1-D

DISTRIBUTION AND MOVEMENT OF PESTICIDE RESIDUES IN THE ENVIRONMENT

Soil

Mobility of pesticides. A major source of environmental contamination results from movement of a pesticide from its site of application. At Beltsville, Maryland, the vertical mobility of over 30 pesticides in soils showed that the aromatic acid herbicides were the most mobile, the phenylurea and triazine herbicides intermediate, and the insoluble chlorinated hydrocarbon insecticides were least mobile. (I) Beltsville, Md. IV-1-A

Persistence of pesticides in the soil. Soil water content and soil temperature affected persistence of lindane and methyl parathion in acid soil. In general, persistence was greater in a dry soil than in a wet one, and greater at lower temperatures than at high ones. Losses were slight after three days of incubation, but increased with time. Concentration levels ranging from 0.5 to 5.00 ppm in the soil had no effect on percentage losses with time. (I) Watkinsville, Ga. IV-1-C

Movement of 2,4-D in soils. Movement of 2,4-D in soils is influenced by the exchangeable cation status but to a much less significant degree than in resins. The explanation for the differential movement appears to lie in the solubility of the resulting 2,4-D salts, with salts of the alkali metals being much more soluble than those of the alkaline earths. In natural soils, the mixed character of the exchangeable cations tends to reduce the effect of individual cations, with the result that only extreme differences in exchangeable cation percentage will lead to significant differential leaching rates. (E-fg) New Mex. Agr. Exp. Sta. IV-1-D

Movement of Atrazine in soil. Atrazine transport in a well-aggregated latosolic soil was measured in laboratory columns under both saturated and unsaturated conditions. Atrazine movement was not affected measurably by water flux, and water unsaturation resulted only in a higher peak concentration than was obtained with saturated flow. Chemical degradation by hydrolysis was found to have a significant effect on atrazine transport for flow periods greater than a few days. A computer program was developed to allow calculation of pesticide transport with variable adsorption, water content, and flow rate. Comparison of calculated and experimental results demonstrated the need for a more realistic accounting for adsorption-desorption characteristics and dispersion effects associated with variable microscopic flow velocities. (E-fg) Hawaii Agr. Exp. Sta. IV-1-D

National Soil Monitoring Program expanded. The Nationwide Pesticide Monitoring Program was initiated in the States of Maine, Virginia, Georgia, Idaho, Nebraska, and Washington. Soil and crop samples have been taken from one-fourth of the total sites selected for each of these States; however, chemical analyses have not been completed. Sites for other States have been selected and are ready for the program to begin in fiscal year 1969. (I) Maryland, Maine, Va., Ga., Idaho, Nebr., Wash. VII

Water

Reduction of herbicide concentrations in irrigation water. In two canal treatments initial concentrations of 419 and 489 ppm of xylene in water were rapidly reduced as the treated water moved down the canal to concentrations of 3.5 and 13.0 ppm, respectively, at eight and nine miles below the points of introduction. The maximum concentration of dalapon in irrigation water below a section of canal treated at 20 lb/A for control of bank weeds was 365 ppb. The concentration was reduced to 18 ppb in 30 minutes and to 0.1 ppb in 24 hours. A treatment of amitrole at 6 lb/A on banks of another canal resulted in a maximum concentration of 24 ppb in water immediately below the treated section of the canal and of only 8 ppb 30 minutes later. The maximum concentration one mile downstream was only 11 ppb. (I) Denver, Colorado. III-1-A

Herbicide residues in irrigation water. Scientists in Denver, Colorado, developed more accurate and efficient methods of determining residues of dalapon and xylene. The minimum detection levels were 0.1 and 10 ng., respectively. (I) Denver, Colorado III-1-A

Pesticide pollution of farmstead water supplies. The sampling of Maryland farmstead water supplies, begun in 1966, continues. Of 24 farm water supplies in Washington County, five contained chlorinated hydrocarbon pesticides at concentrations above 0.1 ppb. Highest concentration to date was 0.8 ppb of BHC. Of 24 farm water supplies in Wicomico County, one contained chlorinated hydrocarbon pesticides above 0.1 ppb. Highest concentration to date was 1.0 ppb of TCNB. None of the above concentrations were above limits recommended in the Interim Report of the National Technical Advisory Committee on Water Quality Criteria to the Secretary of the Interior. A chlordane-contaminated well in Carroll County, Maryland, has been sampled for 18 months. Chlordane concentrations have fluctuated between 30 ppb and 4 ppb. A small active carbon filter installed on one branch of the system reduces chlordane concentration to acceptable levels at a flow rate of 1 gpm. (I) Beltsville, Maryland. IV-1-A

Pesticide movement and persistence in agricultural watersheds. Pesticide residues in soils and losses in runoff were evaluated on three watersheds. Concentrations of toxaphene and DDT in surface runoff and ground water were less than 1.0 ppb. Toxaphene tended to be concentrated in the top foot of soil, whereas, DDT was found throughout the profile. Between 10 and 20 percent of DDT and toxaphene applied during the past ten years were recovered

from the soil profile. At another location, land treated at the rate of five pounds per acre yielded runoff containing an average of 0.10 ppb whereas, runoff from land receiving no dieldrin contained 0.03 ppb. After 16 months, only 40 percent of applied dieldrin remained in the soil. Removal by crop surface runoff and erosion accounted for only a small fraction of this loss, and there was no evidence of movement in the soil below plow depth. (I) Riesel, Texas; and Coshocton, Ohio. IV-1-C

Pesticides in surface runoff. Simulated rainfall on a bare soil having five percent slope and treated with atrazine at three pounds per acre, resulted in surface runoff losses of less than 0.1 pound per acre. The amount in surface runoff decreased as time between application of herbicide and initiation of rainfall increased. Endrine was applied to sugarcane at another location at the rate of 0.3 pounds per acre. At harvest, only 0.1 percent had been lost in runoff, 5 to 6 percent remained in the soil unchanged, 4 to 5 percent as degradation products, less than 1 percent in the cane plant. Much of the 85 percent unaccounted for is believed to have been lost by volatilization. (I) Watkinsville, Ga.; and Baton Rouge, La. VI-1-C,D

Forest herbicides will not seriously contaminate adjacent waters. A review of research findings indicates that many herbicides and their carriers, when used in a responsible manner, can be employed in forest vegetation control with minimum impact on water quality. These findings predominate: (1) nearly all residues found in streamwater results from direct application of sprayed materials to the water surface; (2) the maximum concentration of herbicide residue in water is a function of the amount of live stream included in the sprayed unit, the ratio of the surface area of the stream to its volume of flow, and the degree of interception afforded by overhanging vegetation; and (3) the length of persistence of chemical residues is a function of the hydrologic nature of the area. (I) Corvallis, Oregon. IV-5-D

Economic analysis of water pollution and other agricultural wastes. Cooperative research continues with Iowa State University. Physical science research has established that sediment movement is a major transmission mechanism for movement of pollutants, particularly agricultural chemicals and plant nutrients, from land source areas into water supplies. Major emphasis is given to the identification of these and other adverse effects from sediment movement and the economic assessment of alternative methods for reduction of adverse impacts. (I and E) Ames, Iowa; and Washington, D.C. V

Atmosphere

Transport and dispersion of fine spray particles. A wind tunnel was completed to provide a means for producing controlled turbulence. Measurements of turbulence were made in the tunnel to indicate the zone where nonvarying turbulence exists. Data analysis procedures have been developed to describe states of turbulence. Limited measurements were made of the turbulence in the boundary layers of thin plates with various shaped leading edges suspended in the air stream. Field measurements were made of turbulence within

and outside of plant canopies. Partially completed data analyses include average air velocity variations, histograms of velocity variations, and auto and cross correlations to describe the natural states of turbulence. (I) Wooster, Ohio. III-1-A

Quantitative measurement of pesticide drift. Spray droplets of dye in water were generated with a spinning disk atomizer, in a low-speed wind tunnel designed for straight, nonturbulent airflow at velocities from one to ten miles per hour. The spinning disk will produce droplet sizes as small as 100 microns in diameter. A different generator will be required for smaller sizes. Fixed photographic film sheets were used to collect smooth-edged impressions of the droplets. Methods for accurately measuring the droplet impressions are being studied. (I) College Station, Texas. III-1-A

E X A M P L E S O F
A C T I V I T I E S A N D P R O G R E S S

TARGET I

TO GAIN KNOWLEDGE OF THE TAXONOMY, BIOLOGY, ECOLOGY,
PHYSIOLOGY, PATHOLOGY, METABOLISM AND NUTRITION
OF PESTS AND HOST PLANTS AND ANIMALS

General

Absorption of EPTC by Grasses. Contrary to earlier published work, studies in Indiana on uptake of herbicides have shown that EPTC is readily absorbed by roots as well as shoots in some species of grass. The shoot zone closest to the seed is apparently the most effective site of shoot uptake of EPTC.
(I) Lafayette, Indiana. I-1-A

Ascomycetes, Basidiomycetes, and Imperfect Fungi. Developmental and cytological studies of Leptosphaerulina australis resolved the nuclear history of the fungus by clarifying the disputed origin of asci. Taxonomic studies on wood-inhibiting fungi of Mississippi led to publication of new species of Botryobasidium, Tharopama, and Harpographium, and clarification of relationships of several imperfect fungi. A 3-month field study of the fleshy fungi of the Rocky Mountains netted 500 collections and facilitated completion of an extensive revision of the genus Discina. Studies of fungi isolated from Pakistanian soils showed species of Aspergillus, Penicillium, and Fusarium to predominate, followed by Paecilomyces, Ulocladium, Curoularia, Helminthosporium, Fusidium, and Trichoderma. (I) Beltsville, Maryland.
(E) Atlanta University. I-1-A

Carbamate Herbicides: Uptake, Movement, and Susceptibility. Studies on the uptake, movement, and metabolism of CIPC, in resistant and susceptible species, have been completed. Though differences in movement of CIPC were found, they were not large enough to account for the different susceptibilities of the species. EPTC, CIPC, IPC, and CDEC did not affect pea shoot growth at any root zone level; but in corn the shoot zone adjacent to the crown root node was extremely sensitive. It is conjectured that this difference in susceptibility may be due to the location of the growing points relative to the treated soil. (E) Lafayette, Indiana. I-1-A

Light Filters and Weed Seed Germination. Filtration of light by living green leaves of plants not only reduces the total amount of light but changes the quality. Plant leaves absorb approximately five times more incident red light than incident far-red. This change in light quality affects phytochrome-mediated germination of weed seed. Leaf-filtration of light under field conditions may be a factor in suppressing the germination of weed seeds on the underlying soil surface once a crop canopy covers the soil. Additional evidence was obtained in Illinois where artificial filters, which absorbed light in the same region of the light spectrum as plant leaves, inhibited the light-controlled germination of lettuce seeds. (I) Beltsville, Maryland, Urbana, Illinois. I-1-A

National Fungus Collections. Specimens now total 718,132; accessions during the year numbered 3,159. Major curatorial activities included considerable progress in working up the 95,000 specimens acquired earlier from Stanford University and the Brooklyn Botanic Garden. Some 43,000 specimens maintained as several separate herbarium segments were combined with the general herbarium to promote efficiency in herbarium reference and loan procedures. Fungus identifications, loans and exchanges of specimens and cultures, and work on nomenclatorial and literature catalogues continued at active levels. Fungal, bacterial, and viral names in 80 manuscripts for publication by Department workers were checked for accuracy and conformity to International Codes of Nomenclature. (I) Beltsville, Maryland. I-1-A

Effect of Rust on Water Movement in Plants. The effect of bean rust on the movement of water within the bean plant has shown that the fungus has a profound influence on stomatal aperture soon after infection. Three to four days after inoculation there is a significant depression in stomatal aperture and water loss from infected plants. This depression continues; however, overall water loss greatly increases shortly thereafter because of mechanical rupture of the epidermis due to sporulation. The normal cyclic opening and closing (circa. 40-50 min. period) of the stomates is also dampened in infected material. (I) Madison, Wisconsin. I-1-B

Fungi of the Neotropics. More than 1,000 fungi were collected on Dominica, B.W.I., including slime molds, plant disease fungi, wood-decay fungi, mushrooms, hyperparasites, soil fungi, and fungi that kill insects. They more than double the number known from this tropical Caribbean island. Taxonomic reports have been prepared on 46 specimens of Ascomycetes and 100 species of Mycomycetes. New species and new records of Mycomycetes have been described and reported from Haiti, Colombia, Guadeloupe, British Guiana, and the U.S. Virgin Islands. A floristic study of Haitian fungi resulted in the first comprehensive treatment of these fungi, including 70 species not previously reported. (I) Beltsville, Maryland. I-1-B

Fungistasis in Soil-Inhabiting Fungi. Fugistasis of conidia of Trichoderma viride and Pestalotia macrotricha occurred on agar discs on a porous membrane over a column of flowing water. Inhibition of germination was caused by leaching of nutrients as shown by reversal of fungistasis when the amino acid alanine was added to the agar disc. Spore germination was inversely proportionate to the period of leaching prior to addition of spores. The microsclerotia of Verticillium albo-atrum were sensitive to soil fungistasis and comparable inhibition of germination was demonstrated by leaching. Fungistasis was reversed by soil amendments with various sugars and amino acids. (E-fg) Ind. Agr. Exp. Sta. I-1-B

Mode of Action of Wildfire Toxin. The mode of action of the wildfire toxin produced by Pseudomonas tabaci has been elucidated. The toxin noncompetitively inhibits plant glutamine synthetase. This leads to an immediate buildup of ammonia to toxic proportions, which is apparently the immediate cause of chlorotic symptoms seen. Another result of glutamine synthesis blockage is inhibition of both RNA and protein synthesis. But, since the symptoms are evident only several hours after treatment, it would appear that the toxic component is the more important symptomatology. The wildfire toxin also induces convulsions in animals. The toxin's effect both in plants and animals can be overcome by suitable concentrations of glutamine administered simultaneously with the toxin. (I) Madison, Wisconsin. I-1-B

Phytohormones and Pathogenic Responses. The tobacco tissue culture system is being used as a model for studying the biological and biochemical effects of phytohormones known to mediate pathogenic responses. Tests indicate that this cytokinin-requiring tissue can be infected with Corynebacterium fascians and the biological response, i.e., induction of differentiation, is qualitatively similar to that obtained with high concentrations of cytokinins. In cooperation with nematologists, a study of the modification of the resistance of tomato seedlings to infection by the root-knot nematode, Meloidogyne incognita, has been carried out. The results of this study indicate the cytokinins can cause plants which are normally resistant to infection by the nematode to become susceptible to infection. (I) Madison, Wisconsin. I-1-B

Etiology of Virus Diseases and Characterization of Certain Viruses. In continuing studies on translocation of tobacco ringspot virus, using split root systems of zinnia, the virus was consistently translocated within 3-4 weeks from points of nematode transmission to roots not exposed to nematodes. Virus was seldom recovered from tops of these plants. Elm mosaic virus was purified and antiserum prepared. Serological comparisons with tomato ringspot virus demonstrated that it was a distinct virus and not a strain of tomato ringspot as has been reported. A virus seriously damaging a planting of tomatoes was shown by serological comparisons to be a strain of cucumber mosaic closely related to tomato aspermy virus. Two apparently new viruses were isolated from a complex in Desmodium sp. Host range, physical properties, transmission, and characterization of the two viruses are under investigation. (E-fg) Ark.Agr. Exp. Sta. I-1-B

Antifertility Activity of Natural Ecdysones and Synthetic Analogs. Certain synthetic ecdysone (insect molting hormone) analogs, when ingested, inhibited larval growth and development in several species of insects. In addition, the natural ecdysones, 20-hydroxyecdysone and ponasterone A, and a synthetic ecdysone analog inhibited ovarian maturation and egg production in the adult housefly. All the effects appear to be related to the hormonal activity of the test steroids. The effects of these hormones and analogs on the insect reproductive system suggests these compounds as models for the development of safe and specific antifertility agents for insect control. (I) Beltsville, Maryland. I-1-C

Compound from Gypsy Moths Shows Antitumor Activity. A substance produced in a search for a more powerful sex attractant was obtained by reducing the combined acids extracted from the abdominal tips of female gypsy moths (Porthetria dispar). The compound was shown to be a keto alcohol; its structure was verified by synthesis and it was named disparolone. Not being attractive to the male moth, the compound was submitted to the Cancer Chemotherapy National Service Center as part of a regular cooperative exchange of compounds. In vivo tests showed inhibition of Walker intramuscular carcinoma 256 in rats. Disparolone has been identified as 7-oxo-cis-10-hexadecen-1-ol. (I) Beltsville, Maryland. I-1-C

The Distribution of Factor S in the Cockroach, Periplaneta americana, and its Role in Stress Paralysis. Bioassay was used to determine that the ventral nerve cord and head of the cockroach, P. americana (L.), contained the highest concentrations of Factor S. A 2-fold increase in the titer of Factor S was observed in insects subjected to 4 hr. of mechanical stress compared with unstimulated insects. House flies injected with 20 ug of the active residue were immediately paralyzed: 85 percent were unable to right themselves within 3 hrs., 60 percent were dead after 24 hrs., and 15 percent of the survivors had a marked impairment in motor coordination. A substance that caused much the same biological response was found in perfusates from electrically stimulated isolated ventral nerve cords of cockroaches. (I) Fargo, N. D. I-1-C

Ecology of Leaf-mining Buprestids. A recently initiated detailed bioclimatic study is designed to determine, under simulated conditions, the climatic and/or host plant interchangeability of representatives of three closely related but geographically separated species of buprestid leaf-mining beetles (of the genus Pachyschelus) that live on closely related host plants, and to determine the possible effects of this interchange on biorhythm, developmental rate, fecundity, food consumption, etc., of the beetles. In addition to the value to general bioclimatological considerations, the results of this study should contribute to a better understanding of genetic versus environmental control of the nutritional requirements, host specificity, diapause, etc., in plant-feeding insects. (I) Washington, D. C. and Brownsville, Texas. I-1-C

Action Spectrum for Breaking Insect Diapause. The portion of the visible spectrum most effective in breaking diapause of oak silkworm (Antheraea pernyi) pupae and codling moth (Carpocapsa pomonella) larvae has been shown to lie between 400 and 520 nanometers. In laboratory experiments less than one microwatt/cm²/nm in this region of the spectrum was required to break diapause. Since homogenates of oak silkworm and codling moth heads exhibit a high absorption of these wavelengths of light, materials isolated from the homogenates are being compared with known compounds of similar absorption characteristics in an attempt to identify the substances responsible for this effect on diapause. (I) Beltsville, Maryland. I-1-C

Amino Acids in Insect Food. Comparisons of diets to determine the effects of RNA, the amino acids histidine and tryptophane, and sitosterol on development in the almond moth showed that RNA added to the control diet produced the fastest growth rate. The amino acid gave slower development, and sitosterol produced a growth rate similar to the control. Although some larvae on tryptophane developed faster than the control larvae, most developed slower. Sitosterol gave the highest survival rate, followed by RNA. Survival was low on histidine and more so on tryptophane. Females on RNA produced the most eggs. The other diets had reproductive rates similar to the control that included casein, glucose dried yeast, McCollom's salt mixture, wheat germ oil, cholesterol and water. (E) University of Florida, Gainesville, Fla. I-1-C

Protein-Carbohydrate Ratio in Insect Food. Comparison of diets to determine the effects of the protein-carbohydrate ratio on development of the almond moth showed that the optimum levels of protein and carbohydrate for development and reproduction were not the same. Faster development occurred at protein-carbohydrate ratios of 25:65 and 5:85. Maximum survival occurred at a 45:45 level. Females produced the most eggs on a 25:65 diet. (E) University of Florida, Gainesville, Fla. I-1-C

Vitamin Complex in Insect Food. Evaluation of the role of the B-vitamin complex on larval growth in the almond moth showed that growth was inhibited or mortality was high when thiamin, riboflavin, pyridoxine, Ca pantothenate, folic acid, biotin, or nicotinic acid were individually omitted from the diet. No significant effect was found when p-aminobenzoic acid, choline, inositol, and vitamin B12 were individually reduced in the diet or omitted. No pupation occurred when sterol was omitted from the diet. Adding K₃PO₄ to the diet enhanced larval growth. (E) University of Florida, Gainesville, Fla. I-1-C

Quinones in Food of Tribolium confusum. Effects on the confused flour beetle of the synthetic quinones p-benzoquinone and methyl-p-benzoquinone in flour differed at treatment levels of 250, 500, 1,000, and 2,000 p.p.m. (by weight). Both natural secretion and addition of synthetic quinones retarded growth in egg, larval, and pupal stages in proportion to concentration. Fecundity was reduced by natural quinone accumulation and by one of the synthetic quinones. The sexes varied greatly in the effect from quinones, but neither showed a consistent response at any quinone level in growth rate, viability, or sex ratio. (E) Cornell University, Ithaca, N. Y. I-1-C

Insect Hormone-like Activity Found in Commercial Compounds. A group of nonsesquiterpenoid compounds currently used commercially as insecticide synergists were found to possess a high order of juvenile hormone activity and species specificity. This discovery reveals several commercially available compounds with insect juvenile hormone activity which may be used to test the potential of such chemicals as agents for insect control. In addition, the synthesis and testing of a number of methylenedioxyphenylterpenoid hybrid compounds indicate this class of chemicals to have great practical potential. (I) Beltsville, Maryland. I-1-C

Oostatic Hormone Determined in House Flies. An oostatic hormone produced by house flies with eggs in their ovaries suppresses the development rate of new eggs. Complete inhibition of a second gonotropic cycle occurs when mature eggs from the first cycle are retained. When extracts from whole mature female flies and from mature ovaries were injected into 24-hr.-old females, egg development was inhibited. The oostatic hormone seems to act like the corpus allatum and prevents the release of juvenile hormone. This hormone has a very specific mode of action and has control potential. A compound that can inhibit the release of juvenile hormone can stop ovarian development and prevent mating in the house fly. This hormone should be effective on other dipterous insects. (I) Fargo, N.D. I-1-C

Histochemistry of House Fly Monogamy Factor. An accessory substance is passed by the male house fly to the female in semen and is responsible for inducing the single-mating response by the females. Histochemical studies of male copulatory ducts and the posterior region of female reproductive tracts reveal that the accessory substance passed to the female is a proteinaceous material. This material contains a high concentration of dibasic amino acid and appears to be chemically similar to the basic proteins present in cell nuclei. Three to four successive matings by the males depletes the stored accessory substance present in the copulatory duct. (I) Fargo, N.D. I-1-C

Human Attractant for Mosquitoes Identified. L-Lactic acid has been identified as the major component of material washed from the skin of human research subjects that attracts female yellow-fever mosquitoes, Aedes aegypti. The L(+)-isomer of lactic acid was several times as attractive as the D-isomer. Persons having the largest amount of the lactic acid on their skin were the most attractive to mosquitoes. Carbon dioxide, also emitted from the skin, is needed as an activator but is not in itself attractive. This discovery resulted from 10 years of basic research to find out how mosquitoes detect human hosts. (I) Gainesville, Fla. I-1-C

The Maintenance of Insect Cell Cultures. Monolayer cell cultures from four insects: Leucophaea maderae, Periplaneta americana, Melanoplus differentialis, and Musca domestica, are being maintained and are available for experimentation. Some of these cultures have grown for more than a year. Short-term organ cultures of tissues from L. maderae and the tobacco hornworm, Manduca sexta, are being maintained and used in endocrine studies. (I) Fargo, N.D. I-1-C

Insect Nutrition. Highly purified synthetic culture media have been developed for the European corn borer, Ostrinia nubilalis, and the cabbage looper, Trichoplusia ni opening the way for detailed studies of the insects' requirements for specific nutrients such as vitamins, amino acids, and minerals. The development of an optimal mineral salt formulation permitted the elimination of wheat germ from the synthetic diet of the corn borer. The looper, however, showed quite different requirements, and wheat germ fractions were eliminated only after extensive revision of the carbohydrate: protein ratios of the rearing medium. The pea aphid, Acyrtosiphon pisum was shown to require sulfur amino acids, methionine and cysteine. Cysteine could be partially spared by either inorganic sulfur compounds or organic substances possessing sulfhydryl groups. Other aspects of amino metabolism were studied, and the species was found to show the expected transaminase enzyme systems. (E-fg) Wisconsin Agr. Exp. Sta. I-1-C

Synthetic Diets Being Developed for Japanese Beetle Larvae. When third-instar Japanese beetle larvae were confined on diets containing an acetone powder of grass, choline chloride, linoleic acid, linolenic acid and Wesson's salts, 61 percent became prepupae and 39 percent emerged as adults. (I) Moorestown, N.J. I-1-C

Lepidoptera Sterilized as Adults Produce Eggs to Serve as Hosts for Egg Parasites. Maximum fecundity from radiation sterilized Lepidoptera could result in increased biological control from egg parasites such as Trichogramma. Tobacco budworm females sterilized as pupae produced only 11 percent of the normal number of eggs. However, sterilization in the adult stage resulted in 55 percent of the control oviposition. Similar increases in egg production were obtained when imported cabbage worms were sterilized as adults. Thus, the adult stages of the two Lepidoptera should be treated when maximum fecundity is desired from sterilized females. (I) Fargo, N.D. I-1-C

Migration of Aphids and Noctuids. Wisconsin served as the NC-67 aphid identification center. All aphids submitted by States cooperating in the migration research were processed. Current collections, and a back-log of aphids on hand from 1960-1966 were completed. All data were entered on IBM cards, along with pertinent weather data, and analyzed by computer programs. The first collection dates of economically important aphids were found to be closely correlated with a midwest weather pattern of a high pressure area on the east, a low pressure area on the west and southerly to south-westerly winds which carried the aphids from southern areas. An aphid identification manual was prepared. When published this will aid in future determinations of aphids caught in various traps, and help in the training of personnel engaged in such work. (E-fg) Wisconsin Agr. Exp. Sta. I-1-C

Migration of Noctuids. Further evidence was obtained on the role of frontal systems in fall return migration of army cutworm moths, Chorizagrotis auxiliaris. Passage of Pacific cold fronts apparently triggers the fall migration and sets up a transport system for returning moths to the Plains. Temporary eastern extensions of the species range result from rapidly moving fronts carrying primary migrants. Secondary migrations following initial dropout occur under favorable wind conditions but permit only limited eastward dispersal. Secondary migrants are characterized by reduced fat bodies and lowered biotic potential. Location is an important factor influencing light trap catches which seem more dependent upon insect movement than the relatively short attractant range. Windbreaks or obstacles can divert additional insects. (E-fg) Nebraska Agr. Exp. Sta. I-1-C

Metabolism of Phospholipids in Insects. Previous investigations have shown that some 20 choline analogs are incorporated into the phospholipids of Phormia regina if given in the diet in place of choline. Four of these compounds have been synthesized, labelled with carbon 14: dimethyl ^{14}C -ethyl choline: ^{14}C -dimethyl n-propyl choline: ^{14}C -dimethyl isopropylcholine; ^{14}C -dimethyl n-butyl choline. The reaction sequence used was to react the mixed dialkyl amine with ethylene oxide to form an N,N-dialkyl ethanolamine. This was then reacted with ^{14}C -methyl iodide to form the choline analog. In the case of dimethyl ^{14}C -ethyl choline, dimethyl amine and subsequently ^{14}C -ethyl iodide were used. These compounds appear to form the same water soluble metabolites as choline in addition to being incorporated into a phospholipid analogous to phosphatidyl-choline. (E-fg) North Carolina Agr. Exp. Sta. I-1-C

Mitochondrial Metabolism in the Indian-meal Moth. Larval mitochondria-oxidized intermediates arising from carbohydrate and protein catabolism at maximal rates were isolated; fatty acids were oxidized to a very limited extent. Oxidation of appropriate substrates was most rapid by mitochondria isolated from fifth-instar Indian-meal moth larvae, but decreased to about 25% of this rate for those from mature sixth-instar larvae. During the same period, the mitochondrial nitrogen in the insect decreased to about 60% of the fifth-instar level. Microscopic examination of isolated mitochondria revealed a classical ultra-structure that was little altered during the growth period. Enzymatic activity decreased in at least one component of the operable shuttle systems capable of transferring reducing equivalents between the cytosol and mitochondria during lipid accumulation. The effect would be to trap reducing equivalents in the cytosol whence they could be used for lipid synthesis. (I) Savannah, Georgia. I-1-C

Mite Development. Oxygen uptake in 3 mite species increases from egg through the adult stage. Resting stages have uptake only little smaller than that of previous active stage. Uptake of mobile hypopus is smaller than that of resting protonymph. Three species of mites common under field conditions developed with fungi as sole food, but 2 other species could not. Two of the five species developed on medicinal herbs, but flour mites did not develop on sterilized herbs in the laboratory. (P.L. 480) Warsaw Agr. Univ., Warsaw, Poland. I-1-C

Manipulating Photoperiods to Damage Insects. The possibility of manipulating photoperiods to upset the normal adaptation of insects to their environment was explored in the laboratory and outdoors. The effect of different schedules of light and darkness in breaking diapause of oak silkworm pupae and codling moth larvae was investigated by exposing the insects in light-tight chambers at 25°C to a 16-hour day (light period) followed by 15 minutes of light at different times during the night (dark period). Peaks of sensitivity to breaking diapause occurred when the 15-minute light breaks were 2 hours after the dark period started or 2 hours before dawn (start of the light period). By contrast, a light break 3 hours before dawn significantly reduced the breaking of diapause. (I) Beltsville, Maryland. I-1-C

Photoperiod Studies. Malathion did not alter the time of day at which the Indian-meal moth deposited the greatest number of eggs. Malathion-treated adults deposited greatest number of eggs on the 1st day as opposed to the 3rd day for untreated moths. Viability and greatest number of eggs produced was less for treated moths. Temperature fluctuations from 24 to 30°C. in phase with normal timing of light did not alter circadian egg production of treated or untreated moths, as was found at 27°C. A 12-hour reversal of the temperature fluctuations during a normal light cycle caused in untreated moths a secondary peak of egg production 6 hours earlier than the normal peak. A combination of malathion and reversed temperature cycle caused a 12-hour delay in the peak oviposition time on the first day. (I) Fresno, Calif. I-1-C

Photoperiod Studies with the Indian-meal Moth. Indian-meal moths emerged in a 24-hour endogenous rhythmic pattern under alternating light-dark cycles. A single light-dark cycle during the pupal stage was sufficient to initiate the rhythm. Response to the light-dark stimulus occurred only after the darkening of the eye pigment in the pupae. The manipulation of the light conditions to produce rhythmic emergence and maximum synchronization of emerging populations expands the potential for improved control methods. Information on exact time of development and activities of the moths will enable better planning of control measures to increase efficiency and lower costs. In alternating light-dark cycles nearly all oviposition by the moths took place during the dark period. Light was inhibitory but a few eggs were laid during this period. Oviposition varied with density of population. Constant stress and agitation in crowded cultures forced oviposition in the light. Light-inhibited females under stress produced fewer eggs and the viability was low. (I) Savannah, Georgia. I-1-C

Photoperiod and Diapause in the Tobacco Hornworm. When eggs and larvae of the tobacco hornworm are reared in artificial photoperiods of 13 hrs. or less per day, a prolonged diapause occurs shortly after entry into the pupal stage. Diapause can be prevented by exposing only the last larval instar to long photoperiods of 14-15 hr./daily cycle. Moreover, diapause can be effectively prevented by introducing 1-min. pulses of light during the "nights" of diapause-inducing light-dark cycles. Continuous recordings of respiration during diapause of the tobacco hornworm show that CO₂ is not released continuously as in the developing insect but rather is released in periodic bursts. This behavior allows for conservation of body water which can escape only through the spiracles which, in the diapausing insect, are kept closed except for the brief intervals when CO₂ is released. (I) Fargo, N.D. I-1-C

A Predator, *Chrysopa carnea*, Stephens Reared on Artificial Diet. An entomophagous insect, the green lacewing, was reared for several generations on a semidefined diet. A unique feeding method utilized cellulose sponges saturated with liquid diet. (I) College Station, Texas. I-1-C

Physiological Studies on Insect Cuticle. Electron microscopy on insect cuticle and cuticular processes: A problem currently debated by cuticle specialists is when and where the microfibers of insect cuticle are formed. Work on the development of the peritrophic membrane of mosquito larvae supports the view that microfibers are formed outside the epidermal cells after secretion by the aggregation of molecules or molecular complexes. Work with processes in the proventriculus of several insects showed that these are a previously uncharacterized (and unnamed) type of cuticular projection. Collaborative work with the Univ. Marburg has shown that the important chemical events of sclerotization occur at a level higher than amino acids. (E-fg) Minnesota Agr. Exp. Sta. I-1-C

Photosensitivity in Insects. The research during 1967 has dealt with obtaining actograph recordings of *Periplaneta americana* (L.) entrained originally to alternating periods of 12 hours light and 12 hours darkness. Following entrainment, the terminal abdominal ganglion, compound eyes and ocelli, separately and in various combinations, were blacked out in different insects before being placed in actograph wheels. The terminal abdominal ganglion was isolated surgically for some experiments and by the use of occluding paints in others. The results indicate that the ocelli are probably the most important photo-receptive site in controlling or altering the phase and/or daily activity period. The blackening out to the compound eyes somewhat changes the activity patterns as compared to control insects, but the change is less than that observed when the ocelli are blacked out. (E-fg) Nebraska Agr. Exp. Sta. I-1-C

Neuromuscular Substances in Insects. Techniques were developed to extract and isolate neuroactive substances on a several kilogram scale of tissue. Extracts were obtained from the crayfish and cricket. Assay of the substances on the isolated nerve cord of the cockroach (P. americana) showed that the purification has provided a substance that has a specific activity of 6.4×10^{10} standard responses per crayfish or 2.56×10^6 responses/mg of crayfish. Infrared and nuclear magnetic resonance spectra of the substance suggest that the substance is a simple organic molecule. (I) Fargo, N.D.

I-1-C

Relationship of Microorganisms and Insect Tissues. The action of lysozyme on bacterioids in situ was studied by injecting the enzyme into Periplaneta americana. The insects were lethargic and poorly coordinated for days, and mortality was high; survivors eventually regained coordination but they had difficulty in molting. Under electron microscopy, the bacterioid cell walls were spherical instead of elongate, and the cell contents were displaced peripherally. This may indicate enzymic degradation of the cell wall ultrastructure permitting lysis of the protoplasm. But additional structures in the mycetocytes were destroyed; and injection of heat-denatured lysozyme had the same effects. Moreover, in pieces of fat body removed from the insect and soaked in lysozyme, the bacterioid cell walls retained normal shape. Thus it appears that the lysozyme was affecting much more than murein cell walls. (E-fg) Minnesota Agr. Exp. Sta.

I-1-C

Taxonomic Revision of North American Sawflies. A revision of Nearctic sawflies (Hymenoptera:Tenthredinidae), many of which are of great economic importance as pests of forest and fruit trees, has long been badly needed and current research is designed to meet this need. Papers are already in press or soon ready to submit for publication reviewing the tenthredinid subfamilies Blennocampinae, Selandriinae, Susaninae, and Heterarthrinae and revising several genera of Nematinae. Similar papers on two other families of this superfamily are completed or nearly so, including: a key to the Nearctic genera of Argidae and revisions of the subfamilies Atomacerinae and Sterictiphorinae and two genera of Sericocerinae; and a revision of the family Pergidae. The papers on Argidae will be the first revisions of this family for North America. (I) Washington, D. C.

I-1-C

New Book on Spider Mite Taxonomy. The large family Tetranychidae, or spider mites, includes many economically important pests of agricultural and horticultural crops. A book entitled "Spider Mites of Southwestern United States and a Revision of the Family Tetranychidae" has recently been published. This book contains a revision on the subgeneric level of this mite family on a world-wide basis as well as descriptions and keys of the spider mites of the Southwest, including descriptions of many new genera and species. The book, with 143 pages and 125 figures, is a result of several years work and will greatly aid the identification and further taxonomic study of spider mites. (I) Washington, D.C.

I-1-C

Taxonomy of Weevils. A wide-ranging taxonomic and biological study of the weevils belonging to the tribe Anthonomini (which includes the boll weevil), has been completed. An intensive taxonomic revision of this tribe based on pupae has been published with keys, illustrations, and descriptions of 47 species in seven genera. Data from the pupal study will be used to re-evaluate the overall classification of the tribe, heretofore based only on adults. Results of the study on adults will be published in the future.

(E) Texas Agr. Expt. Sta.

I-1-C

Partly Sterilized Male Tobacco Budworms Transmit Sterility to Their Progeny.

The male tobacco budworm is sterilized by gamma radiation with a dose of 35 krad. This large amount of radiation reduces the competitiveness of the completely sterile male. Recent studies with semisterilized males mated to normal females show that sterility is transmitted to their offspring and the progeny of such matings are sterile. Consequently, in a sterile-male control program, one might be able to reduce the amount of radiation by more than half and gain the benefit of (1) obtaining a more competitive male, and (2) introducing into the native population chromosomes that cause sterility. Because the progeny from irradiated males exhibit a sex distortion with 2-3 males per female, the total reproductive potential of the population is further reduced. (I) Fargo, N.D.

I-1-C

Bionomics of Trogoderma. To date 7 species of Trogoderma and 33 related species have been collected from various areas of California. Nearly 5,000 food-sample traps have been placed on 339 properties in northern and south-central California to sample populations present. Results of some life history studies under controlled conditions are available for T. glabrum, T. inclusum, T. parabile, and T. simplex. Elytral pattern variations have been examined for 3 species to group patterns into broad categories.

Of 540 stock and field samples of suspected diseased Trogoderma larvae, Mattesia trogodermae was diagnosed from 99% of the properties, Adelina tribolii from 6%, and an unidentified Eugregarine from 40%. Over 3,000 specimens were examined. Incidence of M. trogodermae was low in larvae collected from sterile food samples at 22 properties. (E) University of California, Riverside, Calif.

I-1-C

Insect Vectors of Viruses. Aphid vectors of non-persistent viruses are subjected to various environmental factors during the transmission process. The effect of two factors--physical agitation and light--were studied the past year. It was found that incessant physical agitation altered the probing behavior of the aphids which in turn resulted in a significant decrease in the transmission rate. Presence or absence of light on the aphid vector during the pre-virus acquisition period had no effect on transmission, but absence of light during the virus acquisition period resulted in a significantly lower transmission rate. (E-fg) Hawaii Agr. Expt. Sta.

I-1-C

Alligatorweed. Gibberellic acid at 1.0 ppm greatly increased the germination and growth of dormant axillary buds of excised stems of alligatorweed. Gibberellic acid at lower concentrations and other growth regulators at various concentrations had little effect on dormancy of buds. (I) Fort Lauderdale, Florida. I-1-D

Anatomical Factors in Absorption and Translocation of Herbicides. There was relatively uniform xylem translocation in juniper (Juniperus spp.) branches stored 24 or more hours in the laboratory before testing, indicating that seasonal variations in juniper translocation may not be due to leaf changes from aging but to factors which would affect stomatal closure. The lower epidermis of shrub live oak (Q. turbinella) leaves has numerous tufted trichomes between veins and glandular structures on the veins. These may affect herbicide absorption by the leaf. (I) Flagstaff, Arizona. I-1-D

Effects of Synthetic Chemicals on Drought Tolerance of Weeds. Over 100 chemicals, representing over 20 groups, were screened for activity in raising plant transpiration rates and, therefore, lowering drought tolerance of plants. Chemicals containing the uracil, chloro-triazine, and chloro-phenyl urea moieties were found to be as active, or more active, than atrazine in lowering transpiration rates. None of the chemicals hastened the rate of transpiration. Atrazine, amiben, CIPC, EPTC, and linuron were readily absorbed by germinating soybean seed. Rate of uptake was directly related to concentration of the herbicides in solution. Absorption of all herbicides increased as temperature was elevated. Rate of absorption of herbicides was independent of water absorption, i.e. the herbicides entered fully-imbibed seed. (E) Madison, Wisconsin. I-1-D

Florida Elodea. Studies of subterranean tubers and foliar turions of Florida elodea (Hydrilla verticillata) showed these propagules to be dormant meristems. They appear to be important factors in the rapid spread of the weed over 45,000 to 60,000 acres in areas throughout Florida and into Alabama and Georgia during the past 5 years. Florida elodea has a low nutrient requirement but high nutrient levels enhanced germination of turions. Gibberellic acid at 1.0 ppm produced much greater increases in germination and growth of both tubers and turions than did other chemicals tested. Dormant turions were resistant to all herbicide treatments except 2,4-D at 1000 ppm. (I) Fort Lauderdale, Florida. I-1-D

Fundamental Mechanisms Involved in 2,4-D Action. Studies on the kinetics of action of fumarase have been completed which indicate that fumarase is an enzyme subject to allosteric effects and may be subject to allosteric control by auxins including 2,4-D. The high-polymeric structure of pectin consists of a super molecule of the [(G) (n)](m) type originally proposed by Kertesz in which linear polygalacturonide molecules of approximately 5 to 10-thousand molecular weight are cross-linked by ester bonds to form a large three-dimensional molecule of 10 to 50-thousand molecular weight. This understanding of pectin structure helps to clarify the role pectic substances may

play in the reversible softening of plant cell walls under the influence of the auxins. (E-fg) Wyoming Agr. Exp. Sta. I-1-D

Biochemical Mechanisms of 2-4-D and Other Herbicides. Quantitative changes in the total RNA content of pea seedling roots have been measured by an enzymic procedure. Under the influence of a variety of growth-regulatory and other herbicides, significant changes have been seen. The growth regulators may be divided into two groups. The members of the first group, comprised of Picloram, Dicamba and 2,4-D, induce increases in the tissue RNA content of the root and cause radial expansion of the shoot possibly via ethylene production. The members of the second, comprising IAA, NAA and Amiben do not produce such evident changes in RNA, nor do they cause such marked shoot enlargement. These changes are paralleled by their ability to induce proliferation of secondary meristems. The ability follows the order Picloram = 2,4-D - Dicamba - NAA - IAA. (E-fg) N. Y. Cornell Agr. Exp. Sta. I-1-D

Germination of Halogeton After 10-years' Burial. Halogeton seed buried 10 years had some viable seeds. There were no viable black seeds. Viability of brown seeds averaged from less than 2 to 7% among the various locations where seed were buried. (I) Reno, Nevada; Logan, Utah; Twin Falls, Idaho; and Pullman, Washington. I-1-D

Germination of Weed Seed. The period of exposure to light required for triggering the germination of Potentilla norvegica seed can be reduced from 24 hours to a few minutes by simple manipulations of temperature and inclusion of KNO_3 in the imbibing medium. These laboratory experiments suggest that manipulation of nitrogenous fertilization and cultivation could be used to control the germination of weed seeds in the field. (I) Beltsville, Maryland. I-1-D

Controlling the Responses of Crop and Weed Plants to Herbicides. The rhythmic response of cotton seedlings, in the field and in the laboratory, to the time of application of herbicides (Dicryl, Eptam, Cotoran) were shown to be primarily exogenously controlled, since the rhythm apparently disappeared under constant temperature and continuous light. Investigations are currently underway to determine whether the rhythmic response is related to the rate of penetration of the herbicides; that is, to permeability changes. (E-fg) La. Agr. Exp. Sta. I-1-D

Soil Organic Matter Main Factor in Herbicide Toxicity. Growth chamber studies indicated that wheat plants responded to the same herbicide-soil adsorption mechanism which was found in adsorption isotherm studies performed in the laboratory. Prometryne was strongly adsorbed on clay minerals and soil organic matter. The adsorption mechanism was pH dependent. Preliminary studies indicate that cotoran is adsorbed by soil organic matter in relatively high amounts, but adsorption of the herbicide by clay minerals is sparse. (E-fg) N. C. Agr. Exp. Sta. I-1-D

Herbicides Suppress Growth of Soil Organisms. Siduron, a turfgrass herbicide, suppressed growth of *Azotobacter* sp. under field and laboratory conditions. Its degradation products aniline and 2-methylcyclohexylamine suppressed the growth of several soil microorganisms under laboratory conditions. Ten annual applications of Simazine have lowered the soil population of bacteria. Residues of Picloram applied at rate of 3 lbs/A for control of bindweed affected growth of snap beans after 18 but not after 24 months. Terbacil gives excellent control of annual weeds in apples and peaches but causes injury to dwarf pears. Tenoran continues to show promise for post-emergence weed control in strawberries. Satisfactory control of perennial weeds such as bindweed and climbing milkweed in vineyards and orchards has not been achieved. Yellow nut grass (*Cyperus esculentus*), tall fescue (*Festuca arundinacea*) and Bermude (*Cynodon dactylon*) are increasing problems in turf-grass and no selective chemical control has been found in our studies. (E-fg) Mo. Agr. Exp. Sta. I-1-D

Herbicide Equilibria of Latosolic Soil. Degradation of atrazine to a non-phytotoxic product in 4 Hawaiian latosolic soils was found to be the result of chemical hydrolysis--the replacement of OH-for Cl- in the 2-position of the triazine ring. The reaction is accelerated by increased temperature and decreased pH. The effect of soil water content on the concentration of herbicide in the soil solution was quantitatively predicted by a distribution equation utilizing adsorption and water content data. Variations in soil water content have little effect on the herbicide equilibrium in Kapaa surface soil having high adsorption, but herbicide concentration in solution was inversely related to water content in the subsoil. Adsorption of atrazine was found to increase sharply with decrease in pH below 6.0. This pH response was most apparent on soils containing principally kaolinite and hydrated iron and aluminum oxides. (E-fg) Hawaii Agr. Exp. Sta. I-1-D

Effect of DCPA on Cell and Tissue Development. DCPA when used in germination-seedling stage inhibited elongation of radicle, delayed differentiation and development of lateral roots, and almost completely prevented formation of root hairs. DCPA can be used as a postemergence treatment 4-6 weeks after seeding and we are currently investigating the relationship between seedling-plant development and DCPA toxicity. Phytotoxic levels of pyrazon (5-amino-4-chloro-2-phenyl-3(2H)-pyridazinone) on germinating red beet seeds were established. At 500 ppm germination is almost completely inhibited. At 300 ppm germination is reduced by 50%-growth of radicles of germinated seeds, also reduced by 50%. Anatomical aspects of pyrazon toxicity are currently being studied. (E-fg) Wisconsin Agr. Exp. Sta. I-1-D

Effects of Synthetic Chemicals on Weed Seed Germination. Extramural research at Tuskegee Institute showed that gibberellic acid enhanced germination of johnsongrass, pigweed, quackgrass, and wild mustard seeds; and low concentration of 2,4-D and coumarin reduced percentage germination of seeds. Dormancy of yellow foxtail seeds is apparently due to the impervious nature of the glumes, lemma, and palea because removal of these increased germination 100 percent. Germination of wild mustard seed was increased 100 percent by holding the seed two hours at 70 C. before planting. (E) Tuskegee, Alabama. I-1-D

Larkspur Germination and Growth. In Utah tall larkspur (Delphinium barbeyi) emerges from the soil and grows up into snow before it melts. The later in the season that tall larkspur is exposed by the retreating snow, the shorter its period of rapid growth. Mature plants of species of low larkspur (D. nelsonii) normally survived more than 3 growing seasons in the field. (I) Logan, Utah. I-1-D

Sugars in Mesquite. Mesquite seedlings were analyzed for the presence of sucrose, raffinose, and stachyose. Only sucrose was found. When ^{14}C -urea was applied to leaves of mesquite seedlings, translocation from mature leaves was predominantly acropetally and from immature leaves predominantly basipetally. (I) Tucson, Arizona. I-1-D

Anatomical Responses of Mesquite to Herbicides. Honey mesquite seedlings and small greenhouse plants reacted anatomically in a similar manner to 2,4,5-T and to picloram. Phloem cell proliferation caused an increase in seedling collar diameter. In greenhouse plants, the stem tip curled and died. The hypocotyl and main root enlarged as a result of periderm and phloem cell proliferation. The net xylem cells, particularly the vessels, did not enlarge as much as normal cells. (I) College Station, Texas. I-1-D

Photoperiodism in Nutsedge. In research at Beltsville, Maryland, growth and development of yellow nutsedge responded strongly to differences in photoperiod. Photoperiods of 8 to 12 hours promoted nutlet formation, 12 to 14 hours of light promoted flowering, and 16 hours or more promoted rhizome and shoot proliferation. (I) Beltsville, Maryland. I-1-D

Rush Skeletonweed. Seedlings of the early flowering type of rush skeletonweed (Chondrilla juncea) that emerged in the spring failed to develop floral stems during the first growing season on soil types tested in Washington in contrast to 50 to 100% initiation of stems of the late flowering type that emerged from the soil on the same date. Viability of skeletonweed achenes was lost during 2 years' burial in the soil at all depths tested. Light intensity must be reduced more than 90% to prevent establishment of rush skeletonweed if all other factors are nonlimiting. Development of embryos in achenes was inhibited an estimated 80% following a period of drought when accompanied by above normal temperatures. (I) Pullman, Washington. I-1-D

Spring Parsley. The phenoxy herbicides 2,4-D and 2,4,5-T were effective in reducing the phototoxicity of spring parsley (Cymopterus watsonii). When treatment was followed by warm weather within 4 weeks after treatment, 800 milligrams of the plants were not phototoxic to 1-week old chicks which were used for bioassay. The 800 milligram dosage was the highest single dose which could be administered. Photosensitized birds grown to maturity were malformed. (I) Logan, Utah. I-1-D

Translocation of Organic Arsenicals. The herbicides DSMA and MSMA, applied to the foliage of yellow and purple nutsedge in California, translocated to the tubers and accumulated in amounts sufficient to influence tuber viability and seedling development. Translocation undoubtedly is involved in the effectiveness of these herbicides for control of nutsedge. (I) Shafter, California. I-1-D

Western Ironweed Bud Anatomy, Origin, and Development. Anatomical investigations in Nebraska show that the vegetative bud of the bud shoot is homologous to that of the stem and rhizome of western ironweed (Vernonia baldwini). The transition zone between primary bud shoot and rhizome tissue were anatomically similar to the transition zone between axillary buds and axillary shoots. No barrier to movement of metabolites or water was found at this point. The first buds were fully developed by 19 days after germination and capable of sprouting by 28 days. A pair of seedling buds originates from the outer 2 or 3 layers of cortical tissue in the hypocotyl-root axis. (I) Lincoln, Nebraska. I-1-D

Light Actions on Witchweed Seeds. Research in North Carolina showed that red-light strongly inhibits germination of witchweed seed. A brief exposure to far-red alone had no effect, but exposures greater than 10 minutes had an inhibitory effect. Previous investigations have shown that white light inhibits the germination of witchweed seed and that the inhibitory effect of white light disappears within 24 hours when the exposed seed are held in the dark at 85 F. before stimulation. A brief exposure to far-red light did not reverse the inhibitory effect of several days dark storage at temperatures below 60 F. (I) Whiteville, North Carolina. I-1-D

Witchweed Germination. Long exposure (many weeks) of witchweed seeds in North Carolina to warm, wet conditions in the absence of a stimulus resulted in low or no germination when the seeds were later stimulated. The seeds appeared to remain dormant when the warm, wet conditions were continuous. Interruption of the warm, wet period with a dry or cold period permitted germination when the seeds were again exposed to the warm, wet conditions and stimulated. Apparently the alternating conditions favored witchweed seed germination, and the static conditions favored retention of dormancy. (I) Whiteville, North Carolina. I-1-D

Stimulation and Inhibition of Witchweed with Soil Extracts. Acetone extracts of soils in North Carolina contained substances stimulatory to witchweed seed germination while water extracts of the same soils contained substances inhibitory to germination. (I) Whiteville, North Carolina. I-1-D

The Biology of Plant Parasitic Nematodes. Reproductive cycles of Helicotylenchus dihystra, Pratylenchus zeae, and Trichodorus christiei were studied in outdoor micro-plots for a period of 28 months. Cycles of reproduction as determined by the percentage of gravid females present ranged from 2-5 months for H. dihystra and from 2½ to 7½ months for P. zeae and T. christiei. Although there were periods when these species of nematodes were not recoverable by decanting sieving and root incubation, in most cases following this period of non-recoverability the nematode population could be recovered at a later time. The results corroborate the observation that some nematode species do not reproduce constantly all year round in the tropics even though temperature and food supply are not limiting factors. Continued attempts to axenically culture excised sugarcane roots have not produced positive results. Studies on effect of temperature on reproduction of H. dihystra and P. zeae are in progress. (E-fg) Hawaii Agr. Exp. Sta. I-1-F

Survival and Pathogenicity of Plant Parasitic Nematodes. Survival of root-knot nematode during the winter of 1966-67 was determined in field bins. Larvae free in the soil survived at all depths to the hardpan at 24". They were numerous in first 12"; most in first 6". Egg masses were similarly distributed. Females with attached egg masses were frequently found partially embedded in root fragments. Free larvae and eggs were infective. Infection of test plants also occurred in some cases from root fragments with and without visible females, suggesting females remained infective and/or eggs or larvae may survive in the root pieces. Larvae surviving in the hatched state within the egg masses continued to decline. Survival of infective stages occurred at all depths tested (0-24") including the uppermost 1-inch layer. (E-fg) Ala. Agr. Exp. Sta. I-1-F

Lance Nematode in Cotton, Soybeans, and Vegetable Crops. A new lance nematode, Hoplolaimus columbus, was found in the Sand Hills region of South Carolina where it causes extensive damage to cotton and soybeans. It also reproduces well on and damages snap beans, lima beans, tomatoes, and sweet corn. Nematicides are not used in this area, and resistant varieties are not available. (I) Baton Rouge, Louisiana. I-1-F

Nematode Identification. The identity of the foliar nematode on peonies and lilies imported into the U.S.A. was clarified. The barley root-knot nematode, attacking grains and grasses was found in Illinois. Several important nematodes not heretofore known were found on peaches in Georgia. About 400 nematode samples were received from 30 states and 27 foreign countries which resulted in the discovery of at least 6 new species and accession of valuable data on nematode hosts, occurrence, and distribution. The Department Nematode Collection continued its rapid growth and contains over 6,000 permanent slides and 1,100 vials of specimens. A new superfamily was established to accomodate a new genus and species based on specimens which represent a connecting link between two major groups of nematodes inhabiting soil. An extensive revision of a family of insect-parasitic nematodes was published, and a new nematode parasite of the face fly was described. (I) Beltsville, Maryland. I-1-F

Nematode Physiology. Extramural research at the University of Maryland, indicated that chemical extracts of stem nematodes (Ditylenchus dipsaci) induced collapse of parenchyma cells in peas, but only one population induced necrosis. Other extracts of both populations induced similar reactions; therefore, no definite conclusions can be drawn regarding the nature of resistance of peas to the stem nematode. In extramural research at Rutgers University, selective media have indicated different dietary requirements for Aphelenchoides sacchari and Caenorhabditis briggsae. (E) College Park, Maryland and New Brunswick, New Jersey. I-1-F

Physiology and Host-parasite Relations of Root-knot Nematodes. At Beltsville, Maryland, a system that requires only 7 days for the detection of plant resistance to root-knot nematodes in diverse genetic material has proved valuable in the discovery of resistance to root-knot nematodes in tomatoes. This technique has also proven valuable in studying effects of growth regulation on nematodes in resistant and susceptible plants. The development of cyst nematodes was retarded by a nucleic acid inhibitor. This reaction was partially reversed by the analogs uracil and uridine. In other tests an experimental nematocide, acrylonitrile, increased susceptibility of tomatoes to the sugarbeet nematode 4-fold. (I) Beltsville, Maryland. I-1-F

Soybean Cyst Nematode. Three distinct populations of the soybean-cyst nematode could be distinguished on the basis of plant injury, reproduction of populations on resistant varieties, and morphological variation of nematodes within populations. The soybean-cyst nematode affects about 2-million acres and was identified from 20 new counties in two additional states. (I) Beltsville, Maryland. I-1-F

Animals

Chlorinated Hydrocarbon Storage and Body Fat Depletion. Experiments were initiated to study the relationship of chlorinated hydrocarbon accumulation in the body fat of birds and its effect on survival of the bird upon subsequent feed restriction. Preliminary data indicated that 20 ppm or more of dieldrin in the ration was lethal to chickens during the feeding phase and that the surviving chickens died sooner when feed was restricted. A level of 10 ppm of dieldrin in the ration was not lethal and did not affect time of death during feed restriction. (I) Fargo, North Dakota. I-21-A

Gastrointestinal Absorption of Carbamates in Animals. Absorption studies with the carbamate pesticides, Mobam, Baygon, Carbaryl, Zectran, and Barban, have been conducted with duodenal and ileal isolated intestinal loops established in swine. Initial observations suggest that the absorption mechanism of the carbamates differs from that of glucose. The inclusion of polyethylene glycol in the perfusion solution to solubilize the carbamates appeared to decrease the rate of absorption by about one-third of that observed with physiological saline solutions. Absorption tests with Mobam and Baygon suggest that the rate of absorption from the Thiry-Vella loop of the ileum is slower than that from a Thiry-Vella loop of duodenum. Evidence has been obtained in these absorption tests to indicate that the carbamates are degraded in varying degrees during the course of the perfusions. (I) Fargo, North Dakota. I-21-A

Metabolic Fate of Estrous-Control Chemicals in Swine. The nonsteroid compound (MATCH-ICI 33,828), an estrous-control chemical in animals--especially useful in swine, was synthesized with a ^{14}C label. Rats and swine were dosed with this preparation to study its metabolic fate. Approximately 0.5% of the radioactivity was recovered in the respired CO_2 . Gilts excreted 93.5% (70% in 48 hours) in the urine and 5.5% in the feces over an 8-day collection period. Approximately 30% of the radioactivity in the urine was present as the thiodiazole and the parent compound. Work is in progress on the isolation and identification of the water-soluble metabolites. MATCH appears to be rapidly degraded and excreted by the animal body. (I) Fargo, North Dakota. I-21-A

Rumen Microbial Degradation of Pesticides. Bacteria from ruminal digesta were incubated with ^{14}C -labeled pesticides, monitored for $^{14}\text{CO}_2$ evolution, and the media analyzed for degradation products. The nitro-heterocyclic (Atrazine, Propazine, Simazine), chlorinated hydrocarbon and aromatic (pyridinal, urea, mercurial, quinoline, amide) pesticides were stable in this system. Organophosphate (Bidrin, Diazinon, Guthion), aliphatic hydrocarbon (Tabutrex), carbamate (Mobam), and aromatic (Trifluralin) pesticides were unstable. Pesticide substituent groups that were subject to cleavage or reduction were methyl-, propyl-, carbamate-, nitro-, and phosphorothioate. Breakdown of Tabutrex, an insecticidal repellent for flies on animals and premises, was indicated in a rumen microbe-seeded medium. Succinic, propionic, and butyric acids increased in these cultures. (I) Fargo, N.D. I-21-A

Anaplasmosis Vectors in Mississippi. A 3-year study on possible vectors of anaplasmosis in the Mississippi Delta area indicates that Culicidae are not or, at least, are very poor vectors, and that possible vectors could be Tabanidae and Hippelates. (I) Stoneville, Miss. I-21-C

Dermacentor albipictus Sensitive to Photoperiod. Larvae of Dermacentor albipictus, are found on cattle only in the fall and winter months. When exposed to complete darkness or to 16 hours of light and 8 hours of darkness they did not attach to guinea pigs through 12 weeks post-hatch. Those exposed to 8 hours light and 16 hours dark attached at 6 weeks, and those at 12 hours dark and 12 hours light attached at 10 weeks. (I) Kerrville, Tex. I-21-C

Effects of Inorganic Salts on Mosquito Larvae Distribution. Soil and water samples were analyzed from breeding sites producing Aedes sollicitans, Aedes taeniorhynchus and/or Psorophora confinnis. Chloride and sodium showed the greatest inorganic ion differences between habitats producing the Aedes spp. exclusive of P. confinnis and those producing only P. confinnis. Little or no difference was found between pH, carbonates, bicarbonates, or sulfates and the species breeding in a particular habitat. (I) Lake Charles, La. I-21-C

Face Fly Mating and Nutrition. Studies have shown that both the female and male face fly mate more than once. One male will fertilize an average of 4.8 females in a 24-hour period. As the ratio of males to females increased the number of fertilized females per male decreased. Insemination was not successful with reciprocal mating of the house fly and face fly. Larval studies indicate that a minimum amount of nutrient is required for larvae to pupate but this amount is not adequate for maximum adult emergence. This information will aid in the biological control of this pest. (E-fg) Kentucky Agr. Exp. Sta. I-21-C

Face Flies Move to Western U.S. The face fly has been gradually moving west for a number of years, and large numbers were observed on some herds of cattle in Montana, Idaho, and Oregon in the late summer of 1967 and the spring of 1968. (I) Lincoln, Nebr. I-21-C

Multiple Mating Activity of Male Ticks. Male Amblyomma americanum ticks attached to the host for a premating period of 7-20 days before inseminating the first female. A single male inseminated as many as 37 females. (I) Kerrville, Tex. I-21-C

Oviposition Preferences of Mosquitoes to Inorganic Salts. A series of oviposition preference tests were conducted with adult females of Aedes sollicitans, Aedes taeniorhynchus and Psorophora confinnis. All three species demonstrated definite preferences for various salts and salt concentrations. P. confinnis exhibited a stronger preference for low saline sites than the Aedes spp. All three species avoided sites containing sodium carbonate and sodium bicarbonate salts, which were detrimental to their eggs. (I) Lake Charles, La. I-21-C

Odors Attractive to Screw-worm Flies Captured from Infested Wounds. The odors emanating from screw-worm infested wounds on living sheep have been trapped and extracts have been prepared which are attractive to screw-worm flies. Under outdoor conditions, almost all of the flies attracted and trapped were females. (I) Mission, Tex. I-21-C

Screw-worms Survive Subfreezing Temperatures. Adult screw-worms did not survive exposure for 10 minutes to temperatures of 0-5°F, but many flies did survive exposure for 15 minutes to 10-15°F. These studies are related to high altitude drops of sterile flies. (I) Mission, Tex. I-21-C

Animal Parasites May Increase Absorption of Some Toxins. Preliminary studies indicate that one of the effects of intestinal parasites may be the increased permeability of the intestinal wall to bacterial endotoxins. Experiments conducted with parasitized mice showed an increased absorption of an Escherichia coli endotoxin over non-parasitized mice. Some other bacterial endotoxins failed to show this difference. (E-fg) Colorado Agr. Exp. Sta. I-21-E

Chromosomes of the Cooperia oncophora-surnabada Complex Demonstrated. Chromosomes of the Cooperia oncophora-surnabada were demonstrated for the first time. They were most easily discernible in ova shortly before or shortly following fertilization, but could also be seen in cells of eggs which had developed to the vermiform stage. Photographs were made of the chromosomes for possible reconstruction of the chromosome complement. (I) Auburn, Alabama. I-21-E

Laboratory Cultivation of Livestock Parasites. Advances have been made to provide a laboratory environment and nutrients which will permit growth of parasites outside of the livestock host. A species of Cooperia has been cultivated to the egg laying or sperm producing stage of maturity. Time required for the parasite to reach maturity was similar to that required in the livestock host, but egg production took more than twice as long in the test tube. Refinement of this procedure holds promise of an improved means for studying parasite metabolism, nutrient requirements, anthelmintic susceptibility and possible vaccine production. (E-fg) Florida Agr. Exp. Sta. I-21-E

Oxygen Uptake Studies. Oxygen uptake studies were conducted on infective third-stage larvae of Cooperia oncophora at various temperatures using the standard Warburg technique. Oxygen consumption in microliters per hour per 41,800 infective third-stage larvae ranged between 1.02 at 10°C and 12.25 at 30°C. (I) Auburn, Alabama. I-21-E

Fly Control Improves Livestock Weight Gains. Although biting flies are known to reduce the efficiency of livestock production, accurate measurements of losses incurred are limited. Experiments were conducted for the third year to determine whether flies reduced weight gains in cattle. The animals were penned within a screened area to exclude flies and their performance compared with similar lots of cattle exposed to fly populations. Screened animals gained about one-half pound more per day per animal and utilized total digestible nutrients much more effectively than did those exposed to flies. (E-fg) Minnesota Agr. Exp. Sta. I-22-C

Parasites Affect Mineral Utilization in Calves. Internal parasites are known to reduce the efficient utilization of feed by cattle, but the precise reasons for this have been unknown. Studies are in progress on absorption of minerals by calves infected with Ostertagia parasites. Preliminary results show that the utilization of calcium and phosphorus is adversely affected by these parasites. (E-fg) Louisiana Agr. Exp. Sta. I-23-E

Seasonal Incidence of Clinical Demodecosis in Dairy Cattle. A continuation of a survey of 4 dairy herds in New Mexico, begun in FY 1967, indicates that the highest incidence of clinical demodecosis (visible or palpable cutaneous nodules) is found in May. The rate, including the number of nodules on individual cows and the frequency of infested cows within a herd, declines steadily during the summer, approaching zero in Oct. Significant numbers of infested cows are not seen again until late March or early April. (I) Albuquerque, New Mexico. I-23-E

Blackhead of Poultry. Encouraging results pointing toward an effective means of distinguishing the causal agent of blackhead from a morphologically similar, but benign, histomonad are being provided by the indirect fluorescent antibody technique. The benign histomonad has often been confused with the pathogenic one, and misdiagnoses of blackhead (histomoniasis) have frequently been made because of the morphological similarity of the two organisms. The test is also proving useful in differentiating the true histomonad from several histomonad-like organisms that sometimes occur extraneously in the digestive tract of poultry and may be mistaken for the agent of blackhead, leading to diagnoses of blackhead where none exists. (I) Beltsville, Maryland. I-24-E

Turkey Coccidia Grow in Chickens Given a Synthetic Corticosteroid. Species of coccidia generally develop only in a single host. Eimeria meleagritidis (a highly pathogenic coccidian parasite of turkeys) developed and completed its life cycle in chickens given daily injections of a synthetic corticosteroid, dexamethasone. Although oocysts recovered from the chickens produced severe infections when fed to susceptible turkeys, it is possible that serial propagation of the parasite through chickens may result in attenuation and allow the strain to be used as an immunizing agent in turkeys. (I) Beltsville, Maryland. I-24-E

Diagnosis of a Trichina Infection in Live Hogs by Skin-test with the Use of a New Antigen, Shows Promise. Previously, soluble antigens derived from dried, decapsulated larvae were shown to be undependable to accurately diagnose the disease. A new antigen, derived from isolated trichina cysts which had been dried, fragmented by sonication and suspended in buffered saline, when injected intradermally in the chest region of experimentally infected trichinous hogs, elicited strong, positive reactions at the injected site. The reaction consisted of a small (12 mm) raised area of induration with a small dark red center. The antigen did not elicit this reaction when injected similarly into non-trichinous pigs. The diluent (buffered saline) when injected, likewise showed no reaction in trichinous and non-trichinous hogs. (I) Beltsville, Maryland. I-25-E

N-valeric Acid, a Volatile Fatty Acid, Found in Trichinous Hogs. The fatty acid is the main end product in both aerobic and anerobic fermentation of carbohydrates in some nematodes. Part is excreted as free acid while another part may be excreted in the form of ammonium salts. The acid is rarely encountered in the metabolism of animals. Since it is present in the metabolism of Trichinella spiralis as an identifiable fatty acid, the detection of it could serve as an aid in the diagnosis of trichinosis. Initial gas-liquid chromatographic tests disclosed that n-valeric acid was present in T. spiralis larvae, larvae-containing cysts, and cyst-containing pig muscle. Also, it was found in other muscle systems, organs, and blood serum from trichinous pigs. Tissue from non-trichinous hogs have none or only trace amounts. N-valeric acid content above trace amounts may be diagnostic of T. spiralis infections. (I) Beltsville, Maryland. I-25-E

Hide Damage by Sheep Ked. Extensive tests with sheep experimentally infested with Melophagus ovinus have demonstrated for the first time, causal relationships between the parasite and a pathological skin condition. This condition is reflected in damage to tanned hides, resulting in several millions of dollars loss annually. Fortunately, the sheep ked, a one-host parasite, can be readily controlled by means of wide variety of available and acceptable insecticides. The study, certain aspects of which are still being investigated, is conducted in cooperation with the Hides & Leather Laboratory, EURDD, ARS. (I) Albuquerque, New Mexico. I-26-E

Immunological Responses of Sheep to *Psoroptes ovis*. One of the objectives has been to ascertain the immunological response of the hosts to the scabies mite, *Psoroptes ovis*. Half of the sheep have been continuously infested, while the other half consists of a succession of health, previously unexposed replacements. On the basis of clinical condition of the hosts and other considerations, no differences were found to exist between the two groups. It is therefore concluded that, although, there is serological evidence of the existence of circulating, precipitating antibodies against psoroptic mites, they are not of a protective nature, and do not visibly alter the course of the parasitism. (I) Albuquerque, New Mexico. I-26-E

Haemonchus contortus, the Large Stomach Worm of Sheep, May Over-winter as Fourth Stage Larvae in the Sheep and Become the Source of Pasture Contamination in the Spring. Lambs, experimentally infected with 8,000 larvae of *H. contortus*, were examined at necropsy at 18, 45, 90, 135, 180, and 225 days after infection. Fourth-stage larvae were recovered from lambs at all necropsies. The finding of these fourth-stage larvae after four months helps to explain the epidemiology of reinfestation of pastures inasmuch as the inhibited larvae developing from infective larvae ingested the previous fall may mature within the sheep the following spring and become the source of contamination of pastures. (I) Beltsville, Maryland. I-26-E

Psorergatic Acariasis in a Laboratory Flock of Sheep. An effort to intensify the virulence of the skin parasite of sheep, *Psorergates ovis*, for purposes of chemotherapeutic investigations, has been unsuccessful during a four year study. In 1965, a total of 7 infested sheep and 19 uninfested recipient hosts were combined to establish an experimental flock. The flock varied in size from 25 to 48 members, rams and lambs included, between 1965-68, and was maintained in close contact in either one or two small pens. In 1965, the incidence was 28%. In 1966 it attained a maximum of 32% in one segment of the flock and 22% in the entire flock. In 1967 it dropped to only 4.5%, and in 1968, rose slightly to 7%. Experience with psorergatic acariasis in this flock is characteristic of the disease in the U.S.A., where it has been known for nearly 20 years. (I) Albuquerque, New Mexico. I-26-E

Development of Equine Piroplasma in the Horse Tick. The development of one of the etiologic agents, *Babesia caballi*, in the tropical horse tick, *Dermacentor nitens*, was studied in smear preparations and histologic sections of infected ticks. Most of the parasites in equine erythrocytes ingested by the adult ticks apparently were destroyed. Small spherical bodies, 4-6 μ in diameter, were the first developmental stages observed in the gut contents of the ticks. These bodies apparently gave rise to clavate (club-shaped) bodies 10-14 μ long by 4-6 μ wide. The latter developed into large round bodies 12-16 μ in diameter that segmented into vermicular parasites about 8-12 μ long and 2-4 μ wide. Some of these vermicules penetrated the gut wall and invaded other cells of the tick. Vermicules that invaded the developing eggs underwent a similar multiple fission cycle during the larval stage of the next tick generation. Vermicules from the multiple fission cycle that occurred when the larval ticks were feeding, invaded the salivary glands.

A type of multiple fission cycle occurred within these glands and resulted in ~~large numbers of~~ small, oval to piriform parasites (2.5-3 μ long). These became mixed with the salivary secretions, and presumably are the forms injected into the horse by the feeding ticks. (I) Beltsville, Maryland.

I-27-E

Oxygen Uptake by Oocysts of *Eimeria stiedae*. Oxygen uptake studies were conducted on unsporulated oocysts of *Eimeria stiedae* at various temperatures. The standard Warburg technique was used to check the respiration of approximately 2.3 billion oocysts per flask. Oxygen consumption in microliters per hour per flask ranged between 2.2 at 5°C and 24.9 at 35°C. (I) Auburn, Alabama.

I-28-E

Field Crops

Biology of Yellow Mealworm. Knowledge of the biology and ecology of the lesser mealworm is needed in a study of its transmission of acute leucosis to chickens. Mealworm pupae and adults can now be sexed by morphological features. Small squares of white paper clipped together are efficient oviposition sites. Eggs hatch only within a temperature range of 70° to 100°F., but the relative humidity can range from 7 to 95%. Preoviposition for virgin females is 9 days at 80°F. Starvation induces early pupation in late-instar larvae. (E) University of Maryland, College Park, Md.

I-31-C

Fat Metabolism of the Khapra Beetle. The biology of the khapra beetle from India was studied with reference to diapause at various temperatures and population densities. Proteinaceous globules in the fat body were numerous. Their clinical nature and function in insects is not understood, but complex cytochemical reactions and possible similarity in chemical composition to yolk spheres of insect eggs were shown. The globules are destroyed during pupation. Quantitative studies on fat, glycogen, and protein in normal and diapause larvae showed an enormous increase of these metabolites during diapause. Fat and glycogen were the chief sources of energy during diapause. With food available, body weight, fat, and glycogen content were constant during 3 months of diapause, indicating replenishment of the metabolites by intermittent feeding. (P.L. 480) Maharaja Sayajirao, University of Baroda, Baroda, India.

I-31-C

Humidity and Insect Behavior. Fourth-instar larvae of *O. surinamensis* were given two-way choices in relative humidity, light intensity, or both. In darkness, the larvae showed a hygronegative response to a pair of alternative humidities differing by 40%, regardless of the position of the alternative pair on the relative humidity scale. The reaction was most intense at humidities near saturation. It declined to a weak response at 90-50% R.H. and then remained constant to 40-0% R.H. The intensity of the reaction at 100-60% R.H. did not vary at temperatures between 15° and 45°C. The response at 100-60% R.H. was significantly weaker in uniform light than in darkness.

When humidity was uniform, the larvae showed a photonegative response to alternative light intensities. When the dark side of the chamber was moister than the light side, the photonegative response dominated the opposing hygro-negative response at 90-50% R.H. and 70-30% R.H. At 100-60% R.H. the opposing reactions canceled one another. (I) Savannah, Ga. I-31-C

Site of Humidity Perception by Insects. Tests were run to determine if the antennae are the site of humidity perception. The third (terminal) antennal segment bears a sensory field consisting of a large cone-shaped sensillum and numerous smaller sensilla. Larvae from which the second and third segments of both antennae had been removed no longer responded at 100-60% R.H. It appears, therefore, that one or more of these sensilla mediate the humidity response. (I) Savannah, Ga. I-31-C

Salmonella Infesting Grains. The rice weevil, Sitophilus oryzae, will pick up and transmit Salmonella montevideo on the exoskeleton after being in infected wheat for 24 hours. One out of 200 samples of wheat from country elevators was positive for Salmonella serotype S. meuchen. Salmonella had survived in wheat under normal storage conditions for prolonged period of time--perhaps years. Most of the molds in 6 samples of wheats and 1 sample of corn were Aspergillus flavus, A. glaucus, Neurospora, Penicillium and Mucor. Bacteria included the genera Aerobacter, Flavobacterium, Achromobacter, Bacillus, the coliform group, and other unidentified groups. Molds of the Aspergillus and Penicillium groups are normal in laboratory insects. The method for extracting aflatoxin has been revised and improved. (E) Kansas State University, Manhattan, Kansas. I-31-C

Water Regulation in Insects. Surgical techniques have been developed for installing micropolyethylene tubes in the hindgut of yellow mealworm larvae for introducing and withdrawing tritiated water from the lumen to measure in vivo the rate of absorption by the rectal tissues. Results indicate rapid movement of water through rectal tissues into the hemolymph. Starved mealworm larvae held at different humidities gain weight by water absorption at R.H. above 90% and lose weight at about the same rate at lower humidities. Analysis of mealworm lipids as substrates for metabolic water production indicate lipids make up 14 to 18% of the live weight of the larvae and more than 50% are triglycerides. Major fatty acids are palmitic, oleic, and linoleic acids. (E) Kansas State University, Manhattan, Kansas. I-31-C

Response of Canada Thistle to Herbicides. The susceptible ecotype proved more responsive than the others to temperature levels when measuring absorption, translocation, and exudation of 2,4-D. However, no differential response was noted on reduction in RNA content due to 2,4-D application when the ecotypes were compared at 80°F vs 60°. RNA polymerase enzyme activity increased more in response to 2,4-D when the resistant and intermediate plants were grown at 80° F than at 60°. Plants of the (S) ecotype showed

a high but essentially equal increase in the level of this enzyme at both temperatures. This enzyme system appears to be the initial site of 2,4-D attack. Studies with radioactive 2,4-D indicate that under proper conditions the amount of 2,4-D that a plant can absorb, translocate and exude is exceptionally high--30 to 45% of the amount applied. (E-fg) N. Mex. Agr. Exp. Sta. I-31-D

Aphid Vectors and Barley Yellow Dwarf Disease. The lateness of arrival of the known aphid vectors of barley yellow dwarf disease was correlated with a low incidence of the disease. This correlation, as well as time of appearance of first disease symptoms, was accurately predicted in the regional forecasting service in Iowa. (I) Ames, Iowa. I-32-B

A Model for Rust Prediction. Cumulative counts of rust spores caught on exposed surfaces of adhesive-coated rods tell a meaningful story of epidemic development. In Kansas, the method has been used in conjunction with weather records and crop development to predict the course and severity of epidemics. A linear multiple regression model for predicting numbers of spores of leaf and stem rust at different dates beyond a date of forecast was tested. Regression equations solved from spore count and weather data from the 1953 and 1961 to 1965 seasons were used. The log cumulative spore counts on the dates to be forecast were used as a dependent variable with good results of prediction for the spring wheat region. (I) Manhattan, Kansas. I-32-B

Bionomics of Cereal Leaf Beetle. The amount of damage and loss due to the cereal leaf beetle has been quantitated so that it is now possible to ascertain economic levels of infestation. The results of a new survey technique used in 1967 give a clearer picture of the build-up of the cereal leaf beetle in areas where it has dispersed. (E-fg) Indiana Agr. Exp. Sta. I-32-C

Greenbug Feeding Reduced Photosynthesis. The major effects of greenbug feeding appear to be localized in infested barley, oat, and wheat leaves. Cumulative amounts of feeding produced a quantitative, detrimental decline in chlorophyll content and the rate of photosynthesis. There was an increase in respiration. Leaves of resistant plants, in responding to feeding damage, maintained a higher chlorophyll content and a higher rate of photosynthesis than those of susceptible plants. (I) Brookings, S. Dak. I-32-C

Food Packaging Related to Control of Insect Pests. Effort was expended cooperatively with processors of dry cereals to determine locations of Trogoderma larval development in processing plants and mode of entry into the food stream and packages. Evidence points to the success of these insects in crevices of conveyors, boots, separators, blenders, and exhaust systems where deposits of processed grains and additive normally accumulate. Preventive procedures during processing should therefore be more important against Trogoderma than package design. Sophistication of detection techniques continued; progress was made toward early detection of infestation through egg isolation. (E-fg) Indiana Agr. Exp. Sta. I-32-C

Lesser Mealworm Found Carrier of Microorganisms in Stored Grain. The life cycle of the lesser mealworm, Alphitobius diaperinus, was monitored under controlled conditions. The insect eggs hatched in 3 to 6 days. The number of larval instars ranged from 8 to 13. Development from egg to adult required 50 to 100 days. A. diaperinus, exposed to a Salmonella contaminated medium under laboratory conditions, carried the bacteria internally for several days. Salmonella and Escherichia coli were recovered from larval and adult stages of lesser mealworm collected from natural infestations in poultry litter. Additional bacteria were collected from within the body of A. diaperinus larvae and adults obtained from field infestation. Bacteria from the larvae included Micrococcus spp., Streptococcus spp., Corynebacterium spp. (E-fg) Minnesota Agr. Exp. Sta. I-32-C

Stored Grain Insects Attracted to Infested Grain. Using a device which gave storage grain insects a choice of air drawn through infested grain or through uninfested grain, more individuals of the following species chose infested grain: confused flour beetle, cadelle, pill-beetles, larvae of window fly, and rust-red grain beetle. Saw-toothed grain beetle showed no preference. (E-fg) Arkansas Agr. Exp. Sta. I-32-C

Root-knot Nematodes in Grain. Field tests with nematocides on the High Plains of Texas indicated that root-knot nematodes (Meloidogyne incognita acrita) reduced grain sorghum yields from 15 to 40 percent. The rate of root-knot nematode increased in grain sorghum fields is less than in continuous cotton, but damaging populations are maintained by growing all present varieties of sorghum in rotation with cotton. Only slight resistance to root-knot nematodes was found in selections from 16 breeding lines of grain sorghum. (I) Lubbock, Texas. I-32-F

Cytogenetics of Wheat. Through the use of telocentric chromosomes, two genes for disease resistance have been mapped. Srl6, a gene for stem-rust resistance from the variety Thatcher, lies on the long arm of chromosome 2B, apparently more than 50 crossover units from the centromere. Pml, a gene for mildew resistance from Axminster, is located on the long arm of chromosome 7A, at least 50 units from the centromere. (E-fg) Missouri Agr. Exp. Sta. I-321-B

Diseases of Oats and Wheat. Time-course studies of the sequence of amino acid release during the germination of crown rust uredospores were continued. No change in the spectrum of 18 amino acids was obtained except for asparagine which disappeared following the first half hour of germination. Similar results were obtained with conidia of Helminthosporium victoriae but not with sclerotia of Sclerotium rolfsii which exhibited a two-peak pattern of amino acid release instead of one. This information should help in the future understanding of the infection processes of these organisms. (E-fg) Arkansas Agr. Exp. Sta. I-321-B

Nature and Variability of Plant Disease Resistance. Corn tissue perfused with extracts from germinating spores of Puccinia graminis was found to be resistant to normally virulent isolates of P. sorghi. The evidence suggests that corn tissues produce a phytoalexin in response to a challenge from P. graminis. In contrast, wheat tissues challenged by extracts from Uromyces phaseoli and P. coronata, do not show a phytoalexin response. Infectivity of spores of several races of P. graminis tritici produced on Selkirk wheat was lower than that of spores produced on other varieties. This characteristic would act to slow the development of rust epidemics. An Australian isolate of P. graminis tritici was cultured in vitro, but North American isolates did not grow. (E-fg) Minn. Agr. Exp. Sta. I-321-B

Self Inhibitors in Common and Bunt Teliospores. Trimethylamine contributes to self inhibition in these smut spores and prevents germination. Four other volatile amines have also been detected. (I) Pullman, Wash. I-321-B

Resistance Linked with Brown Glume Color. Wheat plants that are heterozygous for stripe rust resistance and glume color occasionally develop rust susceptible sectors (leaves and glumes that are variegated or white). In reciprocal backcross and test cross populations, mutants were found in populations representing F_1 's of (P.I. 178383 x Orin). The F_1 can be used as either the female or male in the test cross. One mutant was recovered for every 184 gametes tested. Indications were that a major gene for stripe rust in P.I. 178383 is linked with brown glume color. Columbia bunt resistance to T-5 and T-15 (Rio or Turkey gene) was associated with glume color on chromosome 1B in a cross of Columbia x Elgin. (I) Corvallis, Oreg., and Pullman, Wash. I-321-B

Rust Resistance in Hexaploid and Tetraploid Wheats. The hexaploid wheats, Justin and Little Club, were crossed with the tetraploids, Leeds, Ramsey, Stewart 63, and Sel. 56-1, to transfer leaf and stem rust resistance from the tetraploids to the hexaploids. The hexaploids differed from the tetraploids by one or two genes for leaf rust resistance. In all crosses, resistance was recessive. (I) Fargo, N. Dak. I-321-B

Nutrition of Angoumois Grain Moth. Larvae of the Angoumois grain moth did not develop in farina-bran pellets comprised of more than 30% bran or in germ-bran pellets with more than 10% bran. Newly hatched larvae failed to enter pellets containing 20% or more bran. Shortest larval-pupal periods were for moths reared in whole wheat kernels, averaging 36.1 days. The shortest larval-pupal periods of 37.3 days were in pellets of 70% farina-30% germ. The longest larval-pupal periods, averaging 145 days, occurred in 100% farina pellets. The number of larval instars increased with length of the larval period. The extremes consisted of one larva which had 12 instars in 178 days in farina while another larva molted 4 times in 20 days in whole wheat kernels. (E) Kansas State University, Manhattan, Kansas. I-321-C

Insect Development on Bulgur. Ten insect species have developed in bulgur at 70% R.H. and 80°F. Development took longer than in wheat. Bulgur equilibrates at about 1% lower moisture content than wheat at the same R.H. The larger rice weevil develops faster and produces more progeny in bulgur. (E) Kansas State University, Manhattan, Kansas. I-321-C

Effect of Dockage in Wheat. Certain insect progeny develop more readily in wheat than contains dockage. In a study of factors associated with this preference, wheat dockage (headhouse dust) contained 10 times more ash than clean wheat; 5 times as much fat; and 1/3 more carotene. Dust had 8% protein compared to 13% in clean wheat. Trace mineral analysis indicated that such dockage contained more Ca, Mg, Cu, Mn, Na, Fe, Zn, Ni, and Al than did clean wheat. (I) Manhattan, Kansas. I-321-C

Susceptibility of New Food Product to Insect Infestation. BFP-3 (a new wheat-base high-protein food) was tested to see if it could sustain insect infestations. Cigarette beetles, confused flour beetles, and red flour beetles developed in about equal number on BFP-3. Indian-meal moth development took 5-6 weeks on BFP-3 and 3-4 weeks on the regular laboratory diet. Total yields of adults from 1,000 eggs were 44 and 73%, respectively. (I) Savannah, Ga. I-321-C

Differences in Greenbug Biotypes Investigated. Several differences were found in greenbug biotype A, the original field strain, and B, the current field strain. Biotype A feeds in the vascular bundle, but biotype B feeds in the parenchyma (mesophyll) area of the leaf. Insertion of the stylets in feeding is intercellular and in a curving path by biotype A, but intracellular and in a straight-line path in biotype B. Biotype B is capable of destroying wheats with resistance to biotype A. Differences in nutritional requirements of the two biotypes also were observed. When both were fed on the standard chemically defined diet, biotype A weighed an average of .378 mg in 16 days as compared to .472 mg in 16 days for biotype B. (I&E) Stillwater, Okla. I-321-C

Ultra Violet Light Influences Wheat Stem Sawfly Activity. Increased transmission of solar radiation of wavelengths of 425 millimicrons or less resulted in increased sawfly ovipositing, infestation, and damage in field cages. Additional tests indicated that the amount of ultraviolet reflected by wheat plants depended upon the variety, stage of development and degree of stem elongation. Sawfly preference for oviposition sites is a response of amount of ultraviolet light reflected by plant--the more reflected the more oviposition. (I) Fargo, N. Dak. I-321-C

Genetics of Pathogenicity. The progeny from a cross between a virulent and a nonvirulent culture of Helminthosporium sorokinianum, which causes spot blotch of barley, differed significantly in virulence. Virulence was found to be controlled by genes at more than a single locus. (I) Raleigh, N.C. I-322-B

Chemical Mutations for Crown Rust Resistance. Mutations of oats from seed treated with ethyl methane-sulfonate (EMS) at Ames, Iowa, expressed quantitative resistance to crown rust. A very few lines superior for resistance were identified, however, the fact that mutations produced by EMS showed differential responses to crown rust points up the fact that reactions to crown rust can be modified by chemical mutations. X-ray mutations have not shown the same reaction. (I) Ames, Iowa. I-323-B

Action of Victorin. This specific toxin produced by Helminthosporium victoriae causes abrupt and massive changes in the permeability of leaf tissue of susceptible oats and causes phosphorylated sugars to leak out. It had no such effect on tissue from resistant oats.

The loss of the sugars was directly proportional to the concentration of the toxin used. Since these sugars are restricted to the cytoplasm and do not pass through membranes (plasmalemma, tonoplast), it indicates that the plasmalemma is the site of action of the toxin.

Disruption of the plasmalemma may be a common route through which pathogens that induce loss of turgor cause disease and may define the mode of action of "wilt inducing" pathogens. (I) Gainesville, Fla. I-323-B

Epidemiology of Field Crop Diseases in Nebraska. Spores of Helminthosporium turcicum, causing northern leaf blight of corn, are freely air-borne and display well-marked diurnal and seasonal periodicities. In Nebraska, there was no evidence of dense spore clouds from the south infecting young crops as has been suggested by some workers. Most primary inoculum seemed to be of local origin, possibly from infected corn debris from the previous year's crop. However, more refined trapping methods are necessary to confirm this. If primary inoculum proves to be of local origin, better disease control can be anticipated by using phytosanitary measures. (E-fg) Nebr. Agr. Exp. Sta. I-326-B

Genetics of Northern Corn Leaf Blight Resistance. The relative efficiency of monogenic resistance vs polygenic resistance in corn, to northern corn leaf blight, was examined. Yield was used as the measure of the relative protective value of these two types of resistance. Monogenic resistant single crosses, in the presence of the disease, yielded an average of about 38 bu./A. more than the average of the susceptible single crosses and the polygenic resistant single crosses yielded about 54 bu./A more than susceptibles under the same conditions. (E-fg) Ill. Agr. Exp. Sta. I-326-B

Biotypes of European Corn Borer. European corn borers from additional sources of Alabama, Maryland and Nebraska were compared under caged conditions at Portageville, Missouri to previously-studied biotypes of Minnesota, Iowa and Missouri. Duplicate experiments were conducted at Nebraska, Iowa and Minnesota by respective experiment station or USDA personnel. Diapause

of larvae increased with the northern latitude of population origin. Borers from the various sources also differed in the additional ecological characteristics of survival, number of tunnels made by individual borer forms, and rate of development. Missouri borers under Missouri conditions appeared to survive better on Oh43, a resistant inbred corn, than borers under Nebraska, Iowa and Minnesota environmental conditions, indicating a possible difference of host resistance under warmer ecological conditions than under which the host resistance was developed. (E-fg) Missouri Agr. Exp. Sta. I-326-C

Ecology of Corn Rootworms. The populations of northern and western corn rootworms in 1967 increased markedly in the central and eastern districts of Minnesota. Among the 6 tillage operations tested, "plowed and packed" and "minimum tillage" reduced larval and adult populations and plant lodging. The study to simplify egg sampling methods shows that % of samples with any eggs is proportional to the mean density of egg populations. The study of the distribution of eggs before and after plowing and that of larvae showed that while eggs were moved to the side of the row by plowing, the larvae concentrated in the row. The quantitative relationship between the number of larvae in the single sample and the density of larval population on a per acre basis was established. (E-fg) Minnesota Agr. Exp. Sta. I-326-C

Geographical Biotypes of European Corn Borer Investigated. Field experiments investigating the possible existence of biotypes of European corn borer conducted at Ankeny, Iowa; Waseca, Minn.; Portageville, Mo.; and North Platte, Nebr., with populations from six geographical areas showed (1) a gradient of increase survival from north to south for all six biotypes; (2) decreasing rate of pupation from north to south, which was related to decrease in day length; and (3) decrease rate of development for all six biotypes from 55 days at Waseca (most northern location) to 38 days at Portageville (most southern). (I&E) Ankeny, Iowa. I-326-C

Distribution of European Corn Borer Deterrent. The concentration of European corn borer deterrent 2,4-dihydroxy-7-methoxy-1,4-benzoxazin-3-one was high in all corn strains tested at the seedling stage of plant development. This accounts for the resistance of young corn to the borer. Concentration of this compound decreases as the plants grow, but this decrease is much less in resistant varieties than susceptible ones. (I&E) Ankeny, Iowa. I-326-C

Lasers Used in Studies with Corn Earworm and Tobacco Hornworm. A laser operating at 3.39μ is utilized for radiation of various configurations on the antennae to determine action potential responses in the nervous system. Recordings made by mounting vibrating antennae under the objective of the microscope and directing radiation from the laser beam at various angles onto the antennae. Coded patterns depend upon the spacing, length, and configuration of the sensillae protruding from the antennae and range from alternating signals of high a low amplitude to signals of equal amplitude damped to lower vibrations. The pattern depends on the angle of the incoming radiation and frequency of the radiation. These patterns are being interpreted as coded frequency signals. (I) Tifton, Ga. I-326-C

Insect Species in Stored Corn. Almond moths, corn sap beetles, and maize weevils were the 3 most prevalent insects found in representative samples of shelled corn stored for 8 months in a tobacco warehouse. (I) Tifton, Ga.

I-326-C

Resistance Factor in Corn Studied. The 6-MBOA (6-methoxy-2-benzoxazolinone) content of the leaves and kernels of Stowells' Evergreen corn at different stages of development was determined by chemical analysis. This compound is a factor in resistance of the plants to the European corn borer. It was found that the amount of 6-MBOA declined sharply in corn leaves, from 6950 ppm at 15 days to 63 ppm at 90 days and in kernels from 435 ppm at 5 days to 4 ppm at 30 days. (I) Tifton, Ga., and Ankeny, Iowa.

I-326-C

Diphenamid Affects Rate of Cell Elongation in Corn. Corn seedlings were exposed to varying concentrations of diphenamid for varying periods of time. The effects of the herbicide on growth rate could be observed as early as 24 hours after treatment. Cytological studies indicate changes in the rate of elongation of cells in the root tip and some changes in nuclear action. These studies are being continued. Cytological studies of the swollen tip of trifluralin treated wheat and corn have been undertaken and it has been noted that these tips show symptoms similar to those found in alkaloid-treated tips. Material has been prepared for electron microscopy studies. (E-fg) W. Va. Agr. Exp. Sta.

I-326-D

New Insights on a Fungus Disease of Grasses. Studies on Ustilago striiformis in Illinois confirm that infection of Poa pratensis can take place in the coleoptile. The data show that axillary buds that develop into tillers or rhizomes are also sites of penetration by the smut fungus. It is concluded that the majority of infection occurs through the axillary buds. (E-fg) Ill. Agr. Exp. Sta.

I-331-B

Perloline is the Major Alkaloid in Tall Fescue. This alkaloid is known to be toxic to paramecia and certain warm-blooded animals. Foliar diseases were found to reduce level of perloline in disease-susceptible 'Ky. 31', 'Alta', and 'Goar' tall fescue when sampled in August. Very high level of perloline was found in 'Kenwell', a variety with high degree of tolerance to Helminthosporium. Studies are in progress to determine whether perloline is associated with fescue toxicity. (E) Lexington, Kentucky.

I-331-B

Light Penetration as Influenced by Sun Angle and Crop Cover. In Indiana, microenvironment studies in established alfalfa showed that light penetration is influenced by sun angle and crop cover. Within 10 cm of the top of an alfalfa stand 45 cm tall, high light energy levels existed for 3-4 hours when the sun angle was relatively high. Within 20 cm of the top, energy levels never rose above $0.25 \text{ gm cal/cm}^2/\text{min}$, regardless of sun angle. Energy level was $1.25 \text{ gm cal/cm}^2/\text{min}$ measured above the crop. (I) Lafayette, Indiana.

I-332-A

New Hope for Solving Late Summer Unproductiveness of Alfalfa in the East.

A breakthrough appears to have been made in solving late summer unthriftiness of alfalfa in the East. A field test of experimental lines in Maryland uncovered sizeable differences in resistance to crown and root rot caused by Colletotrichum trifolii. Symptoms of the disease were like those commonly associated with late summer production slump, especially when moisture supply is ample. Disease inoculation techniques were adapted for testing large numbers of alfalfa plants for resistance and highly resistant plants have been isolated. (I) Beltsville, Maryland. I-332-B

Alfalfa Weevil Arrestant Isolated from Alfalfa. Extracts from alfalfa using either a 1:1 acetone - distilled water mixture or distilled water alone elicited an attractant or arrestant response from the alfalfa weevil. Both extracts were deactivated by heat or when left overnight in an uncovered dish at 3 to 5°C. When stored at this temperature in a covered container activity was retained for 12 to 15 days. (E) Blacksburg, Va. I-332-C

Quality Loss of Alfalfa Due to Insect Larval Feeding. A technique was developed for measuring the leaf loss from larval feeding on alfalfa and establishing a relationship between leaf loss and larval populations. This is a measure of quality loss (because the quality factors of hay are in the leaves) and not a measure of yield of forage. (E-fg) Oregon Agr. Exp. Sta. I-332-C

Enzyme Produced by Lygus Bugs Cause Plant Damage. An enzyme endopolygalacturonase, produced in the salivary gland of lygus bug was shown to be the primary cause of the plant damage which results from lygus bug feeding. At dilutions of 1:500,000 the enzyme digested more than 5 mg of plant tissue per hour. Extracts from homogenized whole bugs or the salivary glands were active, but extracts from bugs from which the salivary glands were removed showed no activity. Females showed about twice the activity of males. (E) Davis, Calif. I-332-C

Alfalfa Stem Nematode. The alfalfa stem nematode, Ditylenchus dipsaci, is an important pest of alfalfa in all Western States. It was especially important in 1967 due to the cold, wet spring. Estimated losses to hay in the State of Utah alone were \$1.5 million. Alfalfa selections from crosses made by breeders in Nevada and screened by nematologists in Utah contained selections that were simplex, duplex, triplex, and quadruplex for resistance to the root-knot nematode. Progress is being made in the isolation of quadruplex and triplex genotypes that have high-level resistance for the root-knot nematode, the stem nematode, bacterial wilt, spotted aphid, and pea aphid, along with winter hardiness. (I) Logan, Utah. I-332-F

Nematode Resistance in Alfalfa. Recent research showed that resistance of alfalfa selections to the northern root-knot nematode, and to the alfalfa stem nematode, decreased with an increase in temperature from 20° to 30°C, with no difference in ability of the nematodes to penetrate resistant and susceptible alfalfa. This indicates that resistance in present varieties is temperature dependent. Also, relative humidity determines infection by the stem nematode because alfalfa crown buds were more heavily infected with stem nematodes at high humidities than at low. In field situations, infection was particularly high in Utah, where alfalfa was cut immediately after irrigation. (I) Logan, Utah. I-332-F

Fungus-Virus Interactions in Crown and Root Disease of Clover. Red clover vein mosaic virus (RCVMV) and Fusarium isolates causing root rots have been established in large numbers of individual red clover plants in the greenhouse. The study is not completed, but available data show that RCVMV does act as a stress on the plant. When virus-infected plants are inoculated with isolates of Fusarium causing root rot, plants decline more rapidly than when only the Fusarium pathogen is present. The virus-infected plant's rate of decline is also related to the virulence of the Fusarium isolate used since isolates are highly variable. Greenhouse studies confirm field observations that RCVMV is not lethal in red clover, but the forage yield of infected plants is markedly reduced. Greenhouse tests also indicate that the virus is not seed-transmitted in red clover and crimson clover. (E-fg) W. Va. Agr. Exp. Sta. I-333-B

Sweetclover Weevil Feeding Deterrent Identified. A feeding deterrent in sweetclover which appears to be primarily responsible for the resistance to the sweetclover weevil has been isolated in pure crystalline form. It has been identified by physical and chemical methods as ammonium nitrate. (E) Lincoln, Nebr. I-333-C

Nature of Resistance to Sweetclover Weevil. Deterrent B, found only in sweetclover weevil-resistant Melilotus infesta extracts, was isolated in crystalline form and sufficient material accumulated for structural determination. The white needle-shaped crystals have a melting point of 169 to 170°C, the compound sublimates at temperatures near the melting point at atmospheric pressure, is very soluble in water, soluble in methanol, slightly soluble in ethanol, and is insoluble in the more nonpolar solvents. (E) Nebraska Agr. Exp. Sta. I-333-C

Insects on Mediterranean Sage. Feeding preference tests with the new species of Phrydiuchus from Italy indicate that, although some feeding by the adult weevil occurs on plants of the Labiatae genera Ocimum, Coleus, Mentha, Melissa, Agastache, and Lycopus, only Salvia species, which are most heavily damaged, are favored for oviposition and larval development. Preliminary tests also indicate that a second new species of Phrydiuchus, from Turkey, is considerably more fecund than the Italian species. These weevils are being considered for introduction into the United States as potential controlling

agents of Mediterranean sage, Salvia aethiops, a range pest in Western U.S. A paper providing names and taxonomic descriptions for these two species is now ready for publication. (I) Rome, Italy, and Washington, D. C.

I-334-D

Control of Noxious Shrubs on Southwestern Ranges. The relationship between plant moisture on carbohydrate levels and herbicidal effectiveness were studied on creosotebush near Bowie, Arizona. Types of herbicides were also studied. Granular Picloram and Dicamba were equally effective and both were better than corresponding liquid formulations. Granular herbicides were more effective when applied just prior to summer rains and liquid herbicides were more effective after sufficient moisture fell to promote active growth. No significant relationships were found among moisture or carbohydrate levels and herbicidal effectiveness of liquid formulations. 2,4-D or 2,4,5-T were not effective herbicides for creosotebush. (E-fg) Arizona Agr. Exp. Sta.

I-334-D

Effect of Virus on Seed Set in Birdsfoot Trefoil. A field study was completed in which three clones of birdsfoot trefoil infected with tobacco ringspot virus were compared with uninfected counterparts as related to characters affecting seed set. The virus-free plants had significantly greater numbers of (1) umbels per plant, (2) pods per umbel, and (3) seeds per pod, and differed in weight of 100 seed. A significant clone by virus interaction was shown for all characters except that of weight of 100 seed. (I) Beltsville, Md.

I-336-B

Root-knot Resistance in Lespedeza. Cooperative studies in Alabama and Georgia indicate that much progress has been made in increasing and stabilizing root-knot resistance in Sericea lespedeza to 3 root-knot nematode species (Meloidogyne incognita, M. incognita acrita, and M. hapla). Seventy-four Sericea lespedeza breeding lines from 24 families, were tested for resistance to these nematodes in Georgia. After 4 years of backcrossing, there are now 13 lines from five families possessing good resistance to the root-knot nematodes. (I) Tifton, Ga.

I-336-F

Varietal Tolerance to Herbicides. Soybean strains varied widely in their response to application of chloroxuron. (I) Stoneville, Mississippi.

I-341-A

Biology and Ecology of Insects Affecting Soybeans. Biology of two insects have been completed, Bradsia coprophila and Alydus pilosulus. Alydus pilosulus, a pest of soybeans, transmits yeast-spot disease. Extent of damage to soybeans by B. coprophila is unknown. Damage evaluation showed A. pilosulus produced significant yield reduction at high densities. Damage resulting from various densities of Trichoplusia ni was not reflected significantly on yield. Heliothis zea larval damage was significant when density reached three larvae per plant. Adult bean leaf beetle at 16 beetles per plant caused insignificant differences in yield of Harosoy soybeans. (E-fg) Missouri Agr. Exp. Sta.

I-341-C

Compound Produced by Infected Host Plants is Purified. In Maryland, the phytoalexin produced by the interaction of soybean plants and various challenging organisms has been purified. The phytoalexin reacts with p-toluenesulphonic acid to give a brown color and has maximum UV absorption at 231 and 274 m μ . A spectrophotometric assay has been devised to measure the amount of phytoalexin produced by various host-parasite interactions. (E-fg) Md. Agr. Exp. Sta. I-341-B

Phytoalexin Production and Disease Resistance in Soybean. As the soybean stem tissue ages, it becomes more resistant to *Phytophthora* root rot (*P. megasperma* var. *sojae*). Concurrently, the ability to produce a specific phytoalexin decreases. Apparently there are at least two types of disease resistance in soybeans: resistance in young plant tissue (0-2 weeks old) in which the production of phytoalexin plays an important role; and resistance in older plant tissue (more than 2 weeks old) recognized by a woody condition of this stem tissue and reduced phytoalexin production. (I) Urbana, Ill. I-341-B

Insect-Infested Soybeans. Previously, insect infestation of soybeans has not been a problem. However, an infestation of the cowpea weevil was discovered in 250,000 bushels of soybeans stored in a metal bin in South Carolina. Seventy samples of the soybeans, averaging 524 g., were returned to the laboratory for examination. Initially, 0.26% of the soybeans in the samples were found damaged, and adult cowpea weevils averaged two per sample. The samples were held at a temperature of 26.7% C \pm 1 $^{\circ}$ for 30 days more. After this time 0.54% of the soybeans were damaged, and adult cowpea weevils averaged 15.5 per sample. (I) Savannah, Ga. I-341-C

Soybean Pests in Delaware. Populations of insect pests in 8 soybean fields that were selected as representative of conditions throughout the State, did not become high enough to cause measurable yield reductions. Thrips, reaching a peak early in the season (the week ending July 15) and the green cloverworm, with a population peak in the week ending August 26 and following soybean flowering, were the most abundant insects. Summer rainfall was above normal. (E-fg) Delaware Agr. Exp. Sta. I-341-C

Physiology and Ecology of Weeds and Soybeans. In continuing extramural research in Illinois, soybean yields were reduced by competition with either foxtail or pigweed; pigweed was more detrimental than foxtail. Application of nitrate nitrogen to the soil did not affect the yield reduction due to foxtail competition but increased the yield loss due to competition with pigweed. (E) Urbana, Ill. I-341-D

New Resistant Mutant. In experimental plots at Jackson, Tennessee, where soybean variety Lee was repeatedly grown to maintain populations of the Virginia pathotype of soybean-cyst nematode, a single plant was found that was not attacked by this population. Seed from this plant have been saved and will be used in future breeding programs in the hope of developing resistance to the pathogenic Virginia populations of Heterodera glycines.
(I) Jackson, Tenn. I-341-F

Resistance Stability. Repeated experimental tests for 5 years indicate that the resistance contained in Custer, Dyer, and Pickett, is stable, and so far resistance-breaking mutants of the nematode have not developed. Attempts are now being made to incorporate resistance to the soybean-cyst nematode from Dyer with phytophthora resistance from D-63-6100. Survival of the soybean-cyst nematode in soil is not as long as formerly thought. Cysts in natural soil survive down to 24 inches, regardless of depth, for 2 years, but none were found alive after 3 years in the absence of a host plant.
(I) Jackson, Tenn. I-341-F

Resistance to Soybean-cyst Nematode. In Tennessee, nine varieties and breeding lines resistant to the soybean-cyst nematode were evaluated in three field experiments and several pot tests for yield, lodging, height, oil and protein, maturity and resistance. The newly released varieties Custer, Dyer, and Pickett, and a new selection D-637320-18 (from a Pickett x Dyer cross) are particularly good yielding varieties on infested land. D-63-7320-18 yielded 15.7 bushels per acre more than Hill; it also has good resistance to two species of root-knot nematodes. The Virginia population of Heterodera glycines causes some damage, and this nematode population increases on resistant varieties. (I) Jackson, Tennessee. I-341-F

Physiology of Nematodes in Soybeans. Extramural research at North Carolina State University showed that the larval emergence rates from cysts and egg masses of the soybean-cyst nematode (Heterodera glycines), in several buffer solutions, is much higher at pH 3.5 than at pH 2.5. The magnesium content of soybean roots was found to decrease with an increase in nematode infection; however, this was temperature dependent because light infestations at low temperatures also gave an increase in magnesium. The uptake of other nutrients, and translocation, in root-knot infected soybean plants is not only influenced by infection level but is also influenced by environmental factors such as temperature. (E) Raleigh, North Carolina. I-341-F

Nematodes Causing Losses in Soybeans. The most important nematodes found on soybeans on the Coastal Plains are Pratylenchus brachyurus, Tylenchorhynchus claytoni, Nelicotylenchus dyhisteri, Xiphinema americanum, Trichodorus christiei, and Meloidogyne spp. Lance nematodes (Hoplolaimus spp.) and sting nematodes (Belonolaimus spp.) were infrequently found, but usually cause heavy losses where they occur. The soybean-cyst nematode resistant-varieties Dyer and Pickett were found to be resistant to the reniform nematode Rotylenchulus reniformis. Other varieties such as Bragg, Jackson, Hood, and Lee, are badly damaged and increase reniform nematode populations. The

variety Custer (resistant to soybean-cyst nematode) has not been evaluated.
(I) Auburn, Alabama. I-341-F

Stem Nematode in Soybeans. The stem nematode, Ditylenchus dipsaci, was newly found on soybeans in Illinois. Heavy infestations delay emergence and sometimes cause mortality of plants before emergence. Plants that emerge have twisted and swollen hypocotyls, which become chlorotic and crack. In the trifoliate leaf stage leaves are twisted and distorted. After approximately 6 weeks, streaks of browning occur in the area between the tap root and the cotyledonary nodes. Forty-one soybean varieties tested were susceptible to the stem nematode. (I) Urbana, Ill. I-341-F

Sting Nematode in Soybeans. The sting nematode causes extensive damage to soybeans on the Atlantic and Gulf Coastal Plains. Thirty additional breeding lines of soybeans were tested in South Carolina in 1967 to determine susceptibility and resistance to Belonolaimus longicaudatus. Line LA 63-15-16 (from Pelican-2 x Ogden) had the lowest reproduction index (resistance), but was inferior to line PI-163453 that was evaluated in 1966. (I) Charleston, South Carolina. I-341-F

Yield Losses in Soybeans Caused by Nematodes. During the past 3 years a detailed survey and estimate of losses caused by nematodes on soybeans has been conducted in Georgia, Florida, Alabama, and Mississippi. Based on experimental evidence, population levels determined by surveys, and mean yields (from fields surveyed) as reported by farmers yield losses can be estimated at about 15 percent on 80 percent of the farms where one or more species of pathogenic nematodes have been found. (I) Auburn, Alabama. I-341-F

Nature of Resistance to Flax Rust. Biochemical studies on the nature of rust resistance in flax have demonstrated that ethylene gas production by the flax leaf is stimulated by inoculation with flax rust spores. The amount of ethylene produced depends on whether a resistant or susceptible combination is used. Pathological studies have shown that flax rust infection is significantly reduced as a result of prior inoculation with an avirulent race of rust. Studies on the mechanism of this induced resistance to flax rust suggests that diffusible substances from the pathogen may be responsible for triggering the reaction. (I) Fargo, N. Dak. and (E) North Dak. Agr. Exp. Sta. I-342-B

Environmental Effects on Aflatoxin Formation in Peanut Seeds. Temperature range for aflatoxin production by A. flavus in living cured peanuts was 14-40 C at 98 + - 1% relative humidity (RH). Aflatoxin was found at 84% RH in damaged and immature kernels, but only .029 and .010 ug/g formed in sound mature kernels and kernels from unshelled peanuts, respectively. No aflatoxin formed at 83% RH, 30 C in 84 days. The fatty acid production paralleled fungus growth rather than aflatoxin production. Several other fungi grew at RH and temperatures favorable and unfavorable for the development of A. flavus. The predominant fungi isolated at RH below 84-86% were members

of the A. glaucus group. (E-fg) Ala. Agr. Exp. Sta.

I-344-B

Insect Species in Shelling Plants. Approximately 20 species of stored-product insects have been collected in and around peanut shelling plants during the shelling season. Almond moths, red flour beetles, and merchant grain beetles were the most prevalent species; and the first two accounted for 90% of the total catch in suction-type light traps.

Experiments conducted under field conditions in a shelling plant showed that peanuts were very attractive to stored-product insects. One-pint samples of peanuts left in a shelling plant for 1-7 days showed that 40% of the samples were infested within the first 24 hours. An average of 75% of the samples were infested after 48 hours. Shelled peanuts are often held at the plant from 1 to 3 days awaiting grade certificate and shipping. This could be a major source of infestation. (I) Tifton, Ga.

I-344-C

Nematode Resistance in Peanuts. Thirty-eight peanut varieties or breeding lines were evaluated for susceptibility and resistance to the northern root-knot nematode (M. hapla) and the peanut root-knot nematode (M. arenaria). Only partial resistance was found in several lines. Resistance was more readily found to M. arenaria than to M. hapla. Best resistance to the two species of root-knot occurred in the variety Bradford and Bigboy, and Line SH 62-9/T 1692. Virginia Bunch 67 and Georgia 18-26 were more resistant than other varieties to the lesion nematode (Pratylenchus brachyurus). (I) Tifton, Ga.

I-344-F

The Influence of Plant Root Exudates and Other Substrates on a Cotton Seedling Pathogen. The Nanking variety of cotton (Gossypium arboreum) is highly resistant to the seedling disease pathogen Colletotrichum gossypii. However, when the resistant G. arboreum seedlings were inoculated with C. gossypii and incubated in the presence of a nutrient source (glucose and peptone) the resistance was broken down and the fungal hyphae invaded the seedling roots almost as extensively as it did those of the susceptible Rex variety. Supplying the amino acids, asparagine, valine, serine, and histidine singly, to inoculated roots of G. arboreum also broke down their resistance. Inorganic sources of nitrogen (without a carbon source) did not break down resistance. (E-fg) Ark. Agr. Exp. Sta.

I-351-B

Disease Resistance in Cotton. This project attacks the problem of disease resistance using a conventional field approach to genetic improvement, and a laboratory approach. The laboratory approach presently is directed toward devising a "fingerprint" technique whereby genotypes can be catalogued for degree of tolerance. Phenolics are being studied intensively and show some promise as fingerprints. (E-fg) Arizona Agr. Exp. Sta.

I-351-B

Influence of Boll Weevil Larvae on Abscission of Cotton Squares. Squares implanted with a second instar larvae or with water homogenates of the second or third instar larvae, caused abscission at 4 to 5 times the normal rate. Mechanical damage, implanted eggs, water homogenate of eggs, and water homogenate of first instar larvae did not increase abscission. The specificity of the abscission factor(s) provides an opportunity to study their identity and mode of action. (I) Starkville, Miss. I-351-C

Lipids of Smoothleaf Cotton Studied. The polar lipids in the buds of Delta Pine smoothleaf cotton were separated and identified. In general the percentages of fatty acids followed the pattern found in other cotton plants. An exception was a greater proportion of di- as compared to tri-unsaturated C₁₈ acids in the phosphatidyl ethanolamine fraction. The variations of polar lipid concentrations in glanded and glandless lines of cotton buds are being studied as indicators of feeding stimulant activity for the boll weevil. (I) State College, Miss. I-351-C

Deet Found in Pink Bollworms. In an investigation of natural activators for propylure, the synthetic pink bollworm (*Pectinophora gossypiella*) sex attractant, deet (N, N-diethyl-m-toluamide) was found to occur in female pupae and adults of this insect. Synthetic deet is well known as a highly effective insect repellent developed several years ago by USDA chemists and entomologists. Deet appears to activate the attractancy of propylure, but the full significance in female pink bollworms is not fully understood. It is not found in the males. (I) Beltsville, Md. I-351-C

Hexlure is an Effective Pink Bollworm Sex Attractant. Hexlure (cis-7-hexadecene-1-ol-acetate), a synthetic homolog of propylure, at 1, 5, and 10 mg per trap was less effective in attracting male pink bollworm moths than 50 female equivalents of natural lure per trap but 25 and 50 mg of hexlure per trap were more effective than the natural lure at 50 female equivalents per trap. (I) Phoenix, Ariz. I-351-C

Traps Baited with Sex Lure for Control of the Pink Bollworm. In a field test 100 or 250 traps per acre baited with 60 mg of hexlure per trap gave a high level of control of pink bollworms through August 1968, but failed to control the population in September when heavy migration occurred from untreated fields. (I) Phoenix, Ariz. I-351-C

Cooperative Development of Nematode Resistant Cotton. Cooperative studies to develop nematode-resistant cotton varieties are underway in Louisiana, Texas, Arizona, and California. In 1967, nematode losses on cotton were small, particularly in the Western States, because reduced acreage permitted better rotations involving root-knot resistant alfalfa and grain sorghum. In addition, many cotton fields were clean-fallowed for nearly 12 months in 1966, which drastically reduced root-knot populations. The reduced acreage also permitted farmers to select land that was not infested with root-knot. (I) Baton Rouge, La; Lubbock, Texas; Phoenix, Ariz; Shafter, California. I-351-F

Pathogenicity of Root-knot Nematodes. In Arizona, the cotton root-knot nematode (Meloidogyne incognita acrita) and the Javanese root-knot nematode (Meloidogyne javanica) occur on the Yuma Mesa. Field studies indicate that the pathogenicity of Javanese root-knot nematode is increasing on cotton. Deltapine smoothleaf cotton and G. hirsutum strain A were much more susceptible to the Javanese root-knot nematode than Pima S-3 which appeared resistant. The Javanese root-knot also attacked Pima S-2 and Pima S-4 varieties. All varieties were moderately to highly susceptible to the cotton root-knot nematode. Advanced breeding trials indicate that 10 lines of short staple cotton have root-knot resistance equal to Auburn 56, which has 50% lower resistance to M. incognita acrita than Deltapine smoothleaf. (I) Phoenix, Arizona and Baton Rouge, Louisiana. I-351-F

Root-knot Resistance. Progress is also being made to incorporate root-knot resistance into varieties adapted to the High Plains of Texas. In California, over 10,000 plants were evaluated for resistance, and 13 breeding lines that were segregating for resistance had fewer root-knot galls than Acala 4-42 and Acala SJ-1. Lines N-6032, N-6050, N-6065, N-6079, and N-6032 gave the highest yield increase, had the lowest root-knot index, and had the lowest percentage lint increase over comparable fumigated plots. Therefore, these lines show promise for development into new root-knot resistant varieties suitable for the San Joaquin Valley. (I) Lubbock, Texas and Shafter, Calif. I-351-F

Epidemiology of Tobacco Brown Spot Disease. Continuous trapping of spores of the brown spot fungus, along with complete weather records, showed that the maximum spore release takes place between 9 a.m. and 12 noon each day after the leaves have dried off. The number of spores was related to the number of hours of dew duration the previous night and was little affected by temperature. (I) Raleigh, North Carolina. I-36-B

Successful Lab Rearing of Apanteles Congregatus Accomplished. Successful laboratory mating of this braconid parasite of the tobacco hornworm was obtained through control of ambient light and provision of adequate horizontal resting surfaces. Mating occurred primarily in the afternoon and oviposition in the morning. 1st and 2nd instar hornworm larvae were preferred for oviposition. A complete life cycle was obtained for the first time in the laboratory. (I) Oxford, N. C. I-36-C

Effect of Environment on Cigarette Beetles. Cultures of all stages of the cigarette beetle exposed to 50°F. and 70% R.H. lived for 24 weeks. Others alternated at 4-week intervals between 70°F.-50% R.H. and 50°F.-70% R.H. lived for 32 weeks. Fourth-instar larvae and adults resisted continuous low temperatures longest. Control cultures at 80°F. and 70% R.H. died from a natural toxin within 24 weeks. Insect population was maximum at 12 weeks, then declined in spite of additional medium and larger containers. Eggs and first-instar larvae survived the longest. (I) Richmond, Va. I-36-C

Releases of Marked Tobacco Hornworm Moths Demonstrate Trap Efficiency and Moth Dispersal Ability. Releases of 674 marked male moths were made over a 12-day period on the island of St. Croix. Blacklight traps baited with virgin females captured 151 or 22% of the released moths. Moths dispersed widely from each release site. The releases demonstrated that the use of the sterile male method would require no more than three release sites for the entire 84-mile² island and that baited traps were comparatively efficient in capturing male moths. (I) St. Croix, V.I. I-36-C

Fungitoxins of Corn. Corn line K55 is resistant to Helminthosporium leaf spot. Extracts of 7 week old leaves inhibited the growth of Helminthosporium carbonum and gave an ED₅₀ value of 0.6 g. leaf tissue fresh wt. per ml. of growth medium. At least 3 fungitoxic compounds are present in the extracts. Chromogenic reagents and UV spectroscopy indicate that 2 of the fungitoxic compounds may be 2,4-dihydroxy-7-methoxy-1, 4-benzoxazin-3-one and 6-methoxy-2(3) - benzoxazolinone. (I) Beltsville, Md. I-366-B

Host-parasite Relations in Sugarbeets. In the absence of nematodes, Fusarium oxysporum was not pathogenic on sugarbeets but invaded sugarbeet in the presence of Heterodera schachtii or Meloidogyne hapla. The damage caused by Heterodera schachtii was as severe as the damage caused by both the nematode and the fungus. However, in the case of root-knot, the combined damage of Meloidogyne hapla and Fusarium oxysporum was greater than the damage caused by the nematode alone. In field plot tests in Utah, Temik increased sugarbeet yield 4.75 tons per acre more than DD treatments. The performance of this new carbamate nematicide in controlling sugarbeet-cyst nematodes was spectacular and unusual because few chemicals, other than DD, are effective in controlling these nematodes. (I) Logan, Utah. I-372-A

Sugarbeet Leaf Spot. Greenhouse and field studies have shown that prolonged periods of leaf wetness (such as long dew periods in the field) are directly related to rapid spread of Cercospora leaf spot of sugarbeet, which provides the forecaster with an important key to predicting epidemics. (I) Ames, Iowa. I-372-B

Sugarbeet Wireworm Sex Attractant Identified. Beltsville chemists of USDA, cooperating with scientists of the Canada Department of Agriculture, have identified valeric acid as the sex attractant produced by female sugarbeet wireworms, Limonius californicus. Although this is chemically the simplest natural sex attractant yet discovered, its identification was made from only 18 insects. (I&E) Beltsville, Md., and Canada. I-372-C

Sugarbeet-Kochia Competition. One kochia plant per 25 feet of row reduced the yield of sugarbeets by about 8 percent in Colorado. Percentage of sucrose in sugarbeets was not reduced significantly by competition with kochia until the infestation reached two kochia plants per foot of row. Stand of sugarbeets was not reduced until the infestation reached one kochia plant per foot of row. (I) Ft. Collins, Colo. I-372-D

Horticultural Crops

Red Spider Mite Transmits Tobacco Ringspot Virus. The red spider mite was found to be capable of transmitting tobacco ringspot virus in South Texas. None of the previously known vectors could account for the rapid spread that occurs in the field. With this knowledge, an effective control program can now be developed. (I) Weslaco, Texas. I-41-B

Bionomics of Nitidulid Beetles. Various species of nitidulid beetles have been collected from the following areas: Alabama, Arizona, California, Florida, Georgia, Hawaii, Indiana, Michigan, Mississippi, Nevada, Ohio, and Mexico. Laboratory cultures have been established of Carpophilus lugubria, C. corticinus, C. californicus, C. freemani, C. marginellus, C. mutilatus, C. hemipterus, C. obsoletus, C. dimidiatus, Haptoncus luteolus, Urophorus humeralis, Stelidota geminata, Colopterus sp. Samples of the immature stages of the various species have been preserved, and microslide specimens for morphological study have been prepared. (E) California Department of Agriculture, Sacramento, Calif. I-41-C

Temperature and Insect Behavior. Biology, ecology and behavior studies of Oryzaephilus surinamensis and O. mercator showed that temperature and food affected their rate of development, egg production, life span, preoviposition and oviposition periods. (I) Fresno, Calif. I-41-C

Chemical Pruning of Plants. Fatty acid derivatives that were discovered to be useful for sucker control in tobacco may have a new practical application. These compounds are effective in killing meristematic tissue and can be used for chemical pruning of plants. Terminal growth of such plants as azaleas, chrysanthemums, and a wide range of others is killed by single foliar applications of these compounds causing compact growth similar to that produced by time-consuming manual pruning. Painstaking experiments were required to determine the proper chemical for a certain species of plant, the optimum rate of application, and the right stage of plant growth for application. (I) Beltsville, Md. I-41-G

Alkaloids and Disease Resistance. Steroid alkaloids are found in potatoes and tomatoes and nothing is known positively about what role, if any, alkaloids may play in the disease resistance of these plants. Convincing evidence obtained in the laboratories at Beltsville indicates that a specific chemical form of an alkaloid known as the "free base" is the toxic form. This finding is of fundamental importance. The toxic form of the alkaloid and the conditions in the plant before and after infection which influence the availability of the toxic form must be known before an evaluation can be made as to the significance of these naturally occurring pesticides in the resistance of plants to disease. (I) Beltsville, Md. I-42-B

Epidemiology of Lima Beans and Potato Diseases. The effect of temperature, light, and moisture on colonization of the lima bean fungus and on sporulation have been found to be the same as for the potato late blight disease and therefore the same forecast criteria can be used for both diseases. (I) University Park, Pa.

I-42-B

Leafhopper and Aphid Transmission of Vegetable Crop Viruses. Experiments with materials suspected of having antiviral properties showed that surfactant quaternary ammonia compounds greatly reduced the transmission of beet mosaic virus when mechanically transmitted but not when inoculated by aphids. Conversely mineral oils effectively reduced (90%) aphid transmission of the virus but were much less efficient (50%) in preventing mechanical transfer. Deterrence of aphid vectors of some plant viruses from field plantings was better accomplished with aluminum foil than with other reflective surfaces such as black, yellow and white plastic sheeting when approximately one-half of the soil surface was covered. Infections by beet and cucumber mosaic viruses were reduced by 75% with the former material while systemic insecticides were useless in the reduction of spread of these stylet-borne viruses. The reflective surfaces, however, were ineffective in reducing the numbers of potato flea beetles, and the potato and aster leafhoppers on potatoes, and attacks by three lepidopterous caterpillars on cabbage. (E-fg) Wis. Agr. Exp. Sta.

I-42-B

Biology of Insects Transmitting Viruses to Potatoes. Myzus persicae overwinters in the egg stage primarily on peach and wild plum trees in both early and late potato areas. Aphids disperse from their overwintering hosts to various weeds early in the season, then to emerging potatoes, and are not necessarily blown into the area from a distant southerly source. Alate aphids leave unsuitable host plants during early morning and evening flight periods at: temperatures above 60°F; wind velocities below 2.50 mph; and at a relative humidity below 80%. Aphids which are forced to leave a host plant apparently fly in two flight levels. The majority in the lower flight level make short flights of 250 ft. or less. Many aphids, however, are subjected to updrafts or strong wind currents and disperse indeterminable distances. (E-fg) Colorado Agr. Exp. Sta.

I-421-C

Ladybird Larvae Require 750 Aphids to Mature. In a study of aphid predators and parasites the winter survival of the seven-spotted ladybird beetle was shown to be dependent on abundance of food in the larval stage. The beetles required an average of 750 green peach aphids of all sizes to develop from the newly hatched larva to the pupal stage. (I) Presque Isle, Maine.

I-421-C

Potato Leafhopper-Host Relations. The metabolic utilization of valine and isoleucine enhanced survival of early-instar nymphs of the potato leafhopper. A method for evaluating acceptability of plants for oviposition by the leafhopper is practicable and may aid plant breeders in determining specific leafhopper response to potato plants. (E) Iowa Agr. Exp. Sta.

I-421-C

Nematode Galls in Potato Varieties. In Utah, roots of 18 varieties of potato were galled by the northern root-knot nematode (Meloidogyne hapla). There was noticeable difference in the severity of galling. Breeding lines also differed in number of egg masses produced, nematodes per egg mass, and nematodes produced per unit weight of root. Nematodes produced per gram of root varied from 66 per gram on 'Mono' to approximately 46,000 per gram on 'Bounty'. These data indicate that existing potato varieties have greatly different characteristics in increasing soil populations of nematodes. (I) Logan, Utah. I-421-F

Sprout Prevention in Potatoes. Research is underway toward development of potato lines that can be stored for future use without chemical treatment to prevent sprouting. Tubers of breeding lines are stored for 9 months at 40°F., and tested for quality. This is accomplished by cooking tubers and rating them for darkening. An excellent rating was given the variety Lenape, recently released jointly by Pennsylvania Agricultural Experiment Station and USDA. (I) University Park, Pa., and Beltsville, Md. I-421-G

Role of Cellulase in Red Kidney Bean Disease. A very active cellulase produced by Sclerotinia sclerotiorum may be significant in the pathogenesis of red kidney bean. Large quantities of the enzyme were detected in extracts of infected tissues harvested early in the disease process. The enzyme is produced by S. sclerotiorum grown on autoclaved bean hypocotyl tissue. Crude enzyme preparations were most active at pH 3.0. The fungus also utilized filter paper pulp, cotton fibers, and carboxymethylcellulose as carbon sources for growth and cellulase production. (I) Beltsville, Md. I-424-B

DNA Base Composition of a New Bean Pathogen. A new coryneform bacterium, Corynebacterium flaccumfaciens var. violaceum, produces exocellular purple pigment which is found in purple-colored bean seed and seedlings. This and 2 other strains of the species induce other new symptoms: leaf and pod hypertrophy. This suggests its possible epidemic nature. The DNA base composition as moles % guanine + cytosine (GC) is 71% for the 3 strains of Corynebacterium flaccumfaciens. The GC content is greater than that reported for other Corynebacterium spp. (E-fg) Nebr. Agr. Exp. Sta. I-424-B

Biology and Physiology of Cucumber Diseases. Pathogenesis in the angular leaf spot disease of cucumbers is aided by a bacterial lipomucopolysaccharide (LMP) which acts in protease assays by solubilizing the protein substrates. LMP alters the permeability of the plasma membrane of cucumber cells resulting in a loss of water from the cell into the intercellular spaces. High humidity surrounding the cucumber leaf, along with free water in the intercellular spaces is essential for the full development of the angular leaf spot lesion. Lesions require about 48 hr, cumulative, of a relative humidity above 95% in order to develop fully. Ultrastructural studies on Plasmodiophora brassicae and Uromyces phaseoli indicate that these obligately parasitic fungi are complete with the common organelles found in higher organisms. Resting spores of both organisms were found to contain polyribosomes

suggesting they are capable of an active protein synthesis. (E-fg) Wis. Agr. Exp. Sta.

I-428-B

Aphidius smithii, Pea Aphid Parasite, Established in Washington. Introduced from northern India, Aphidius smithii, a braconid parasite of the pea aphid has become established at Yakima, Washington, and other northern locations. Its unusual hardiness was demonstrated when parasites were captured in flight at Yakima during December and January when the air temperature was 4.4°C. (I) Yakima, Wash.

I-425-C

Sex Pheromone Extracted from Banded Cucumber Beetle. A total of 235,245 virgin females were produced for the extraction of a crude sex pheromone. Sixty-one fractions were bioassayed. Thirteen were more attractive than the crude extract. (I) Charleston, S. C.

I-428-C

Peach Tree Borer Reared on Artificial Diet. Sixteen normal sized moths were reared from 40 larvae placed on a Vanderzant type diet when 2 days old. The larvae were reared individually in diet-filled 1-ounce medicine cups placed in trays filled with a soil-sawdust-peat mixture. The mature larvae left the diet cups and tunneled through the medium extensively before pupating. One successful mating was obtained and the resulting larvae were placed on the same diet. Adults from these larvae have now emerged and mated. (I) Ft. Valley, Ga.

I-431-C

Culture Media for Pseudopeziza Medicaginis. Modified commercial oatmeal agar supported satisfactory growth and sporulation of P. medicaginis. Media are easily prepared, and increased selectivity through the use of antibiotic amendments is promising. (I) University Park, Pa.

I-432-B

Saponins Isolated from Alfalfa Varieties. Saponin mixtures from DuPuits and Lahontan alfalfa were separated into individual components. This was followed by acid hydrolysis of individual saponins in order to identify the aglycone and sugar fractions. The components are being isolated and identified in order to determine their biological effects on alfalfa pests. (E) Research Triangle Park, North Carolina.

I-432-C

New Growth Regulator. A new type of growth regulator has been described which acts on plants through the regulation of ethylene formation. This compound permits easy stimulation of fruit ripening without employing ripening rooms or other treatments. Conversely, ripening of several fruits has been successfully deferred through the application of gibberellin, permitting management of ripening in either the accelerating or decelerating direction. The growth of tubers has been traced to the action of cytokinins; large stimulations of tuber growth are obtained with applications of chemicals of this sort, and natural cytokinins appear to be present in tubers to regulate this type of growth. (E-fg) Ind. Agr. Exp. Sta.

I-43-A

Further Insights on the Spread of Prunus Viruses. Field plots were started in 1962 and in 1963 to determine natural spread of Prunus ringspot virus. In each group of plants, the blossoms were removed each year from half of the trees to prevent pollination. Indexing of the trees showed virus spread to some trees on which blossoms had been left intact. Trees from which blossoms had been removed were still free of ringspot virus. This confirms a previous conclusion that Prunus ringspot virus spreads in the field by some means other than insects, namely, by infected pollen. Photoperiod experiments were made with the leafhopper, Draeculacephala crassicornis. Small second-generation leafhoppers were collected in the field and reared under different photoperiods: 12, 13, 14, 15 and 16 hours of light. None of the adults reared under these conditions laid eggs, indicating an ovarial diapause which does not occur in the field where the insect winters in the egg stage. This is an unusual response and may provide a solution to a number of problems relating to virus transmission. (E-fg) Oregon Agr. Exp. Sta. I-43-B

Influence of Chemical Sprays on Residents of Apple Trees. For the second consecutive year, sprays of various chemicals influenced the kinds and numbers of microflora on field grown Jonathan apple trees. Sucrose caused a significant increase in foliage bacteria and yeast while potassium nitrate and glucose encouraged the build-up of only yeasts. This information will be used in fire blight control studies. (I) Beltsville, Md. I-433-B

Fungicides and Some of Their Physiological Effects on Apple Trees. Bordeaux is one of the most effective fungicides that can be applied to apple trees at early fruit bud formation for control of scab. Current tests show that an application of Bordeaux at the half inch green bud stage will prevent sepal scab infection. Spectrographic analysis of foliage has shown that many apple trees in Maine have a low copper content and if the copper level is raised better tree growth and increased yields result. The most effective means of accomplishing this is to spray copper on newly developing foliage. Current tests show that Bordeaux used for sepal scab control will also raise the copper content of apple foliage to a more satisfactory nutritional level. (E-fg) Maine Agr. Exp. Sta. I-433-B

Blasting of Pear Fruit Buds. Bud blasting due to a fluorescent bacterium (Pseudomonas spp.) during the spring caused considerable loss of pear flower buds. Magness, Moonglow, and Bartlett varieties had respectively an average of 75%, 39%, and 28% of the flower buds affected. Because infected flowers never produce fruit, these results indicate that this disease could play a major role in pear fruit production. Blasted buds oftentimes show the presence of bacterial ooze making it difficult to distinguish from blighted (fire blight) buds which also may show bacterial ooze. (I) Beltsville, Md. I-435-B

Fruit Fly Behavior and Disease Transmission. Research on the possible relationship between "brown spot" on passion fruit and fruit fly attack on Kapoho, Hawaii, indicated that fruit flies do not cause this disease. Continued studies on feeding behavior of fruit flies showed a definite decline in the amount of food in the "stomach" during the dry season and an increase during the fall months, indicating either a greater amount of available food or greater feeding activity during certain seasons. The effectiveness or lack of effectiveness of bait sprays might be related to this variation in feeding behavior. (E-fg) Hawaii Agr. Exp. Sta. I-437-C

Further Research Needed in Chemotaxonomy of a Strawberry Pathogen. The protein patterns of 8 races of Phytophthora fragariae, obtained by polyacrylamide gel electrophoresis, were identical with 9 distinct bands having equal E (f) values. A variation in 2 or 3 weak bands was evident but not to a significant extent in characterizing the races. Immuno-diffusion studies also gave negative results. Cross antigen and antisera reactions of the 8 races did not reveal distinct differences between races. (E-fg) Ill. Agr. Exp. Sta. I-452-B

Native Pollinators of the Blueberry. Additional data concerning the ecological life history of several species of solitary bees were collected. Emphasis was placed on Andrena regularis and a rather complete picture of this species is now available. Information on species and abundance of parasites and predators of A. regularis was also gained. It was found that predaceous beetles in the genus Meloe are present at times as are parasitic bees in the genus Nomada. Parasitic flies in the family Conpidae were the most abundant parasites collected, and Myopa vicaria was found to be the most abundant species. Soils data show that A. regularis and several other species of solitary bees on the "blueberry barrens" prefer well-drained nesting sites containing a low organic matter content in the horizon. (E-fg) Maine Agr. Exp. Sta. I-452-C

UV Effects on Botrytis. Sporulation of the fungus causing Botrytis disease of ornamentals is increased by an increase in ultraviolet (UV) radiation. (I) University Park, Pa. I-46-B

Greenhouse Whitefly Life Table and Insecticide Resistance Study. The developmental period of the greenhouse whitefly was studied under the control conditions of a growth chamber and determined to be 36 days at 60°F, 23 days at 80°F, and 31 days under the greenhouse conditions of 65° night and 85° day temperatures. Eggs hatched in 6 days at 80°F, 12 days at 60°F and 10-11 days in the greenhouse. Young nymphs and newly-emerged adults are more susceptible than other stages to insecticides. (I) Beltsville, Md. I-461-C

Wilt Symptoms in Chrysanthemum Varieties. In greenhouse studies combined inoculations of chrysanthemums with Meloidogyne hapla and Fusarium oxysporum increases the severity of wilt symptoms on the Yellow Delaware cultivar in Georgia; the wilt-resistant Yellow Iceburg cultivar failed to show wilt symptoms after 3-months, even when inoculated with nematodes. The nematodes completed their life cycle in roots of both cultivars, but the nematodes alone did not appreciably affect plant growth. (I) Tifton, Ga. I-461-F

Forests

Another Orchid Virus is Purified. The Vanda mosaic virus from infected blossoms showing breaking of color was purified by rate density gradient centrifugation of partially purified preparation in a 10, 20, 30 and 40 percent sucrose density column. Rate density centrifugation assay showed that chloroform emulsification of crude extract yielded relatively clean Vanda mosaic virus preparations. Antisera were prepared for the Vanda mosaic virus and the Cymbidium mosaic virus. Serological tests of important commercial orchid stock showed wide distribution of Cymbidium mosaic virus in such collection including those of important commercial mericlone lots. (E-fg) I-463-B
Hawaii Agr. Exp. Sta.

The Columbian Timber Beetle. Size of the host trees related to susceptibility was investigated and defined mathematically. Patterns of time and space distribution are being defined. Population studies will provide information leading to a prediction system of spatial distribution in Indiana; a further understanding of the characteristics and causes of outbreaks, and knowledge of control by biotic agents. (E-fg) Indiana Agr. Exp. Sta. I-463-C

Deer Threaten Black Cherry Seedlings. Direct seeding of black cherry offers a way of increasing the amount of this valuable species in the hardwood forests of western Pennsylvania. A study of direct seeding showed that germination was as good on unprepared seedbeds as on scarified and exposed mineral soil, in contrast to seedbed requirements of conifers and other light-seeded species. Rodents, birds, and cutworms caused some losses but major damage was done by deer. In many localities in western Pennsylvania and New York, deer preclude establishment of cherry. Thus, direct seeding is a good way to plant cherry but the plantings must be protected from deer. (I) Warren, Pa. I-5-A

Mountain Beaver Damage Trees. Mountain beaver clip stems and branches of many woody plants in the Tillamook Burn, Oregon, where repeated wildfires have killed thousands of acres of timber and brush. The exact role of this small burrowing animal as a modifier of habitat for tree growth and wildlife production was investigated in cooperation with the Oregon State Game Commission. Among 12 plant species studied, vine maple, red huckleberry

(whortleberry), and red alder were clipped most frequently. Results suggest that mountain beaver can produce and maintain sizable openings in brush stands. Composition of woody plants can also be controlled to some extent through selective clipping by these animals. This knowledge is another step toward a better understanding of the complex plant-animal relationships. (I) Olympia, Wash.

I-5-A

Screens Protect Seeds Better Than Chemicals. Successful regeneration of western larch on cutover or burned-over areas may require artificial means when an adequate natural seed supply is not present. Results of a spot seeding study in northern Montana showed that drought, insolation, frost heaving, and fungi caused most of the seedling mortality; loss to animals was slight. Coating seed with chemical repellent was only partially successful; use of screens to protect seed spots from animals was successful but expensive. Knowledge of the relative importance of several mortality factors provides direction for future studies to improve regeneration success. (I) Missoula, Mont.

I-5-A

Compatability Studies in Wood-Rotting Fungi. Isolates of wood rot fungi, developing adjacently in culture grow homogeneously together if the colonies have a common origin, e.g. isolates from the same sporophore. Colonies of independent origin form dark lines of interaction at colony interfaces. Lines form with such regularity as to be used by pathologists in delineating field infections, but previous critical study has been made of the reliability of the phenomenon for the employed purposes. Frequency of line formation was tested by pairing colonies of Fomes cajanderi of known relationship. Fewest lines formed when relationship was closest, e.g. 48% when sibcomposed dikaryons were paired with a monokaryon ($A'A^3 \times A^1$). Most lines occurred (95%) when dikaryons were paired with either related ($A A \times A^1$) or unrelated monokaryons ($B B \times A^1$), except 100%, where totally unrelated dikaryons were paired. Field delineations would be highly reliable with this fungus and generalizations to other fungi probably are valid. (E-fg) Oregon Agr. Exp. Sta.

I-5-B

Movement of Fungi Through Twigs and Branches of Trees. Verticillium albo-atrum is a sapwood inhabiting fungus causing wilt of many genera of trees. The movement of the fungus through the sapwood and the physiological effect of the fungus on the invaded wood is being studied. Spores were readily forced through twigs and branches of green ash and tulip tree, but not through twigs and branches of sugar maple which have much smaller vessels. Balloon-like enlargements of cell walls (tyloses) were found in vessels of stained sections of Russian olive sapwood invaded by the fungus. These tyloses plug the water-conducting vessels and hinder the movement of water. When abundant, they cause foliage wilt. Tyloses were not found in vessels of fungus-invaded sugar maple sapwood. However, the vessels were plugged with gums which also may reduce sap flow and cause foliage wilt. (E-fg) Ill. Agr. Exp. Sta.

I-5-B

Physiology of Parasitism of Fungi Causing Wilts of Plants. Wilting of foliage is a relatively rare symptom in oak wilt, Dutch elm disease, persimmon wilt, and Fusarium wilt of tomato. By means of a newly devised method of measuring water movement in branches it was found that a greater rate of movement occurred in diseased Dutch elm branches than in healthy ones. (E-fg) Ark. Agr. Exp. Sta. I-5-B

Factors Affecting Severity of Littleleaf Disease of Southern Pine. The effects of individual soil organisms on sporangial production of Phytophthora cinnamoni, cause of littleleaf of southern pine. Non-sterilized leacheates of soils from several littleleaf sites have been tested with positive results. Individual isolates (fungi, bacteria, and actinomycetes) obtained from these leacheates are currently being tested for their ability to induce Phytophthora to form sporangia. (E-fg) Ala. Agr. Exp. Sta. I-5-B

New Technique for Study of Blister Rust. The first successful laboratory culture of the fungus, Cronartium ribicola, in western white pine tissue was obtained on the same chemically defined medium used for culturing healthy pine tissue. This technique gives researchers a tool for studying the parasite in a completely controlled environment, and may prove to be a bridge toward establishing the rust organism in pure culture. Infected tissue cultures also provide a means of evaluating the effects of environmental factors and of materials such as antibiotics and fungicides on the host-parasite system. (I) Moscow, Idaho. I-5-B

Physiology of Decay Fungi in Living Trees. Oxygen and carbon dioxide concentrations were measured in red oaks and marked quantitative differences were found between concentrations in tree trunks and in the atmosphere. In laboratory tests, dry weight production of four wood-decaying organisms was measured in liquid cultures under various oxygen and carbon dioxide concentrations. The response varied among the organisms but, in general, dry weight production decreased with a decrease in oxygen concentration below atmospheric levels and with an increase in carbon dioxide concentration from zero. Thus, these gases may influence the activity of wood-decaying organisms in living trees and perhaps play a role in the inactivation of decay columns. (I) Delaware, Ohio. I-5-B

Interactions Among Dwarf Mistletoes. Taxonomic studies of the genus Arceuthobium in the West have determined the host ranges of the various species. An intriguing result of this work is the discovery of interactions among the parasites. If one mistletoe species is present on a tree species, it tends to exclude other mistletoe species from attacking the host in the locality. For example, the lodgepole pine dwarf mistletoe, A. americanum, is common on ponderosa pine outside the range of the typical ponderosa pine parasite, A. vaginatum, but rare within it. The reasons for this exclusion are being investigated. Discovery of why dwarf mistletoes are excluded from certain areas, might open up a whole new field of control possibilities. (I) Ft. Collins, Colo. I-5-B

Distribution of the Oak Wilt Fungus in Infected Trees. Investigations of host-parasite physiology in oak wilt indicate distribution of the causal fungus, Ceratocystis fagacearum, during development of the disease and the relationship of this distribution to leaf symptom expression and resistance to water movement in the xylem. In general, the pathogen is distributed throughout the stem of infected oak seedlings prior to leaf symptom expression. Retardation of water movement occurs just before or at the time wilt symptoms appear in the leaves. This knowledge provides leads on the nature of resistance and development of other control methods. (I) Delaware, Ohio.

I-5-B

Nature of Resistance to Fusiform Rust. Evaluations of resistant and susceptible responses by Southern pines to infection by Cronartium fusiforme were made. Mycelial development of the fungus was greater in the more susceptible pines and less in the resistant. However, even resistant species had considerable fungus mycelium within their tissues. In all species mycelial development was limited to the area of the needle visibly discolored and movement up and down the needle seemed to be rather restricted. This has led to further experimentation to determine how important needle infections actually are in terms of stem gall development. It is possible that some pines susceptible to needle infection may still be essentially disease resistant due to the failure of the fungus to spread to stem tissues and form the lethal galls. (I) Asheville, N. C.

I-5-B

Root Rot Fungus Cannot Survive in Forest. Studies of outplanted white fir infected with Macrophomina phaseoli, the cause of charcoal root disease, indicate that forest environments are not favorable sites for the establishment of this fungus. In similar plantings in agricultural soil, the fungus was able to maintain a high population in the roots of white fir. Thus, fears of introducing the fungus to the forest from the nursery are not warranted. Failure of the fungus to survive is probably due to microbial antagonisms in forest soils and may lead to biological control of the problem in nursery soils. (I) Berkeley, Calif.

I-5-B

Spore Germination and Penetration by Heartrotting Fungi. Basic studies of spore germination and penetration by heartrotting fungi indicate that the common host specificity of these organisms is not conditioned by factors controlling spore germination. Where spores of one fungus would germinate, all would germinate and vice versa. However, difficulty was experienced in germinating spores of several fungi under any conditions. Internal dormancy may be involved as may the presence or absence of associated yeasts and bacteria. Studies of this are underway. Several compounds have been isolated from the bases of eastern white pine branch stubs and tested for their effect on spore germination. Some are inhibitory, but their effect in nature has not been determined. These may also effect penetration. (E) Penn. State University.

I-5-B

Aerial Photographs Record Balsam Woolly Aphid Epidemic. Aerial color photography has been used to follow the trend of Fraser fir mortality over a 5-year period in a balsam woolly aphid outbreak area in North Carolina. The extent and amount of tree mortality were related to population trends of the insect. Equations were derived to provide an index of cumulative damage. A crown closure comparator was devised to aid in photo interpretation and estimation of volume losses. This method provides a quick, reliable, and relatively inexpensive means of getting quantitative data on trends and current cumulative damage levels of destructive pests such as the aphid--with the added advantage of a permanent visual record. (I) Asheville, North Carolina.

I-5-C

Ambrosia Beetle Attractant. A volatile substance was found which attracts the striped ambrosia beetle. Trypodendron lineatum (Oliver) and is produced only by the feeding, mated female. Histological studies of Trypodendron lineatum and the two species of Gnathotrichus have shown that marked changes in size and appearance occur in the organs that are connected with metabolism, i.e. Malpighian tubes, pericardial cells, salivary glands, the glands of the vegetative nervous system and in the structure of the fat body. Correlation between these changes and the production of the attraction is being investigated. Cooperation with the University of British Columbia on the identification of the attractive substance of the Douglas-fir beetle was established. (E-fg) Oregon Agr. Exp. Sta.

I-5-C

Artificial Diets for Forest Insects. Newly hatched larvae of the smaller European elm bark beetle, the primary vector of Dutch elm disease, were reared through adulthood on an artificial medium. The developmental period was four weeks. The coneworm, Dioryctria abietella, can now be reared successfully on an artificial medium in less time per generation and less mortality than in cones. An improved diet has been developed for the Pales weevil, resulting in faster development and increased survival. (I) Delaware, Ohio; Raleigh-Durham, N. C.; Olustee, Fla.

I-5-C

The Large Aspen Tortrix. Currently in outbreak numbers over 10,000 square miles in the area of Fairbanks, Alaska, this insect has not caused tree mortality as yet, but it has materially reduced the radial growth of attacked trees. It is well adapted to the cold; overwintering larvae can withstand temperatures of -40°F. with no adverse effects. (I) Fairbanks, Alaska.

I-5-C

Chemical Communication in Termites. Evidence indicates that building behavior in termites is a direct consequence of low-level alarm stimuli and that its immediate function is defense. As in other forms of termite defense behavior, recruitment of nymphs and workers is accomplished by trail laying in conjunction with transmission of the alarm. The number recruited is related to the intensity of the input stimulus. Primary construction ceases when the original causal stimulus is eliminated by the effects of the actual building. This work outlines the types of communication system prevailing

in termites and shows the interaction of a chemical (Pheromone) one with a tactile. Once a communication system is known it may be possible to disrupt it, disorganizing the insects and so controlling them. (E-fg) North Carolina Agr. Exp. Sta. I-5-C

Significance of Ips Bark Beetles and Associated Fungi Causing Death of Pine. Survival of weakened loblolly pine trees to bark beetle attack was observed and related to diameter, height, oleoresin exudation rate, and dominance characteristics. Trees with diameters in excess of 5 inches were less susceptible to attack when compared with smaller trees and trees 40 feet or more in height were less susceptible to attack than the shorter trees. Oleoresin exudation rate, measured in centimeters per hour in capillary tubes, was the most precise indicator of susceptibility. Trees with an o.e.r. of less than 1 cm/hour were very susceptible to attack. Oleoresin exudation rate was directly related to size of tree and severity of weakening. Ips avulsus was the most aggressive species encountered in the tests. The beetle attacked both the basal and crown portions of the tree, while another species, Ips grandicollis, was found in the basal portion and only in conjunction with Ips avulsus. (E-fg) Arkansas Agr. Exp. Sta. I-5-C

Natural Interbreeding of Bark Beetles. Closely related species of Dendroctonus bark beetles constitute a hazard if accidentally introduced into each other's natural hosts. Interbreeding experiments with D. pseudotsugae from Douglas-fir and D. simplex from eastern larch, using these host tree species and western larch, showed that each beetle reproduced best in its natural host but western larch was most suitable for interspecific pairings. The D. pseudotsugae females failed to produce progeny when paired with D. simplex males, indicating a hybrid sterility factor that might be useful in biological control. (I) Missoula, Mont. I-5-C

Coneworm Adults Respond to Host Tree Stimulants. Detailed electrophysiological studies of the responses of coneworm adults to extracts from slash pine conelets showed strongest reactions to α -pinene and d-limonene. Ethanol extracts gave more marked responses than those utilizing methylene chloride, benzene, chloroform, and ether. Chloroform and carbon tetrachloride extracts of cone material elicited strong responses, also. (I) Raleigh-Durham, N. C. I-5-C

Biotic Factors Regulate Gypsy Moth Populations. The numerical abundance of the gypsy moth is determined primarily by several biotic factors that are host-density related. In dense populations, disease in the late larval stages is the major cause of mortality. In sparse populations, predation of the large larvae and pupae and dispersal loss of the small, newly-hatched larvae are most important. The white-footed deer mouse Peromyscus appears to be a very effective predator and, when sufficiently abundant, can hold sparse gypsy moth populations in check. Detailed knowledge of the critical factors affecting natural populations of pest insects, such as the gypsy moth, is essential for sound and effective integration of control methods and evaluation of their long term effects. (I) Hamden, Conn. I-5-C

Hemolymph Protein Patterns for Disease Diagnosis. Hemolymph protein patterns in acrylymide gels have been studied to identify the proteins in normal versus diseased insects. Standard healthy patterns have been established for the gypsy moth and compared with diseased patterns. Preliminary patterns have been obtained for the European pine sawfly. This technique has considerable promise as a diagnostic tool. (I) Hamden, Conn. I-5-C

Parasites of the Southern Pine Beetle. In east Texas, 26 species of hymenopterous parasites have been found associated with the southern pine beetle. Nine are confirmed parasites of this beetle and Ips engraver beetles. Because they are generally sparse, occur irregularly during the year, and are not host-specific, most of these parasites are not effective in reducing beetle populations. Roptocerus xylophagorum, Dendrosoter sulcatus, Heydenia unica, and Coeloides pissodes seem to have the best potential for use in biological control because of the synchronization of their life cycles with that of the southern pine beetle and associated Ips and their relative abundance. (I) Alexandria, La. I-5-C

Radiography Used to Detect Tip Moths. A radiographic technique was developed to detect and identify tip moth larvae, pupae, parasites, and predators in pine shoots. This will allow detailed study of these insects over a meaningful time span without alteration of their natural microenvironment. (I) Athens, Ga. I-5-C

Fungi Associated with Southern Pine Beetle. Two species of fungi have been isolated from the mycangium or fungal tube of the female southern pine beetle. One is similar to the fungus utilized for food by ambrosia beetles, and the other is related to the blue stain fungus of the genus Ceratocystis. Marked changes in the sugar makeup of the inner bark, on which the beetle feeds, follow infection by these microorganisms. These changes may be vital to egg production and to brood development and survival. (I) Alexandria, La. I-5-C

Southwestern Pine Tip Moth. Life history studies have shown that this insect overwinters in the pupal stage under the litter and surface soil at the base of a tree. Adults begin to emerge in late March, peak emergence occurring in late April--early May. Eggs are laid on the inner surface of the previous year's needles. The larvae feed on the expanding terminal and lateral shoots from mid-June to mid-July, then travel down the stem to pupate in the soil. The commercial production of ponderosa pine on cutover areas and burns in northeastern Arizona may be dependent on successful control of this pest. (I) Albuquerque, N. M. I-5-C

Termites Respond to Fungal Stimulants. One source of attraction to wood for termites has been revealed by cooperative studies at the University of Wisconsin. Four species of termites were shown to respond in various degrees to extracts from woods decayed by some common fungi. (E) University of Wisc. I-5-C

Translocation Patterns in Southern Pines. Longleaf, shortleaf, slash, and Virginia pines 31-35 years old were injected with acid fuchsin dye and then sectioned. The pattern of water conduction in these species proved to be the spiral type, in which the tracheids ascend in a clockwise direction around the axis of the tree. Tracheid alignment in the branches was parallel to the branch axis. This information is basic for subsequent tests of systemic insecticides. (I) Raleigh-Durham, N. C. I-5-C

Impact of Tuliptree Scale. Feeding by this insect on yellow-poplar can remove more than four times the carbon normally assimilated by a 15-foot tree. Carbon losses of about 25 percent result in twig mortality, and continued losses of this magnitude for three years will kill the tree. (I) Delaware, Ohio. I-5-C

Herbicides Control Weeds Without Injury to Trees. Planted hardwood seedlings are very sensitive to competition of other plants. Herbicides offer one of the best possibilities. In an old field in east central Iowa, a plantation of four hardwood species on a silt loam soil planted to 1-0 stock, 4 pounds of active atrazine or simazine controlled weeds effectively without injuring the trees. Chemical weed control was better on plowed and disked ground than on unprepared ground. Yellow-poplar and white ash grew faster on prepared ground. Black walnut and red oak did not respond to ground preparation treatments. These findings are the basis for guides to develop a cheaper method of establishing hardwood plantations. (I) Carbondale, Ill. I-5-D

Herbicides More Effective Than Sod Removal. Competing vegetation must be removed or deadened to obtain successful establishment of planted ponderosa pines in the Southwest. Six herbicides--dalapon, an ester of dalapon, simazine, amitrole, amitrole-T, and ammonium thiocyanate--were compared on perennial grasses in Arizona. All except ammonium thiocyanate killed the grass. Dalapon, however, was the cheapest. Applied at a rate of 5 pounds of active ingredient per acre, dalapon killed 86 to 94 percent of the grass at about one-third the cost of sod removal. (I) Flagstaff, Ariz. I-5-D

Essential Oils of Douglas-Fir Needles Control Digestion in Deer. Research supported by a Forest Service grant at the University of California showed that high levels of essential oil distilled from Douglas-fir needles decreased deer rumen microbial action on alfalfa below that on alfalfa alone, indicating poor digestibility, while low levels stimulated rumen microbial activity. These findings point to two possibilities: first, the development of more effective chemical repellents using chemicals that inhibit digestion; and, second, genetic selection and breeding of strains of trees containing higher concentrations of digestion-inhibiting compounds. (E) University of California, Davis, Calif. I-5-G

Small Mammals No Threat to Tree Seedlings in Alaska. Foresters and ecologists have been concerned over the possible destructive role of small mammals such as mice, voles, and shrews, in reforestation after clearcutting of western hemlock-Sitka spruce timber stands in southeast Alaska. A 9-year census study showed that the white-footed mouse population was consistently lower on the cutover land than in uncut timber. Vole and shrew populations increased somewhat on the cutting in some years, but remained low. Adequate natural conifer regeneration became established on the cutover plot from seedfall and residual seedlings despite the presence of small mammals. These results indicate that the natural ecology on cutover timberland in southeast Alaska need not be further disrupted by attempts to control the small mammal population. (I) Juneau, Alaska. I-5-G

TARGET II

TO IMPROVE AND DEVELOP MEANS OF CONTROLLING PESTS BY NON-PESTICIDAL METHODS

General

Heat Control of Nosema Disease. A temperature of 120° F for 24 hours has been found to be effective in virtually eliminating Nosema apis from honey combs. (I) Beltsville, Md. II-1-B

Rusts and Their Hyperparasites. Fungi and insects were found to destroy many rust fungi in Dominica, B.W.I. The fungus genus Darluca was abundant on rusts of grasses. Tuberculina was very common on rusts of herbs and shrubs. Insect larvae and mites were invariably present feeding upon rust spores and were found to contribute to the spread of the rust pathogens. Other insects ate host plant and rust, often destroying the lesions before the rust could sporulate. The same types of hyperparasites and predators occur in the United States but are more destructive in Dominica. Darluca and Tuberculina seemed particularly destructive of rusts and may offer some potential as biological agents in their control. (I) Beltsville, Maryland. II-1-B

Parasitism of Almond Moth Eggs. Laboratory experiments showed that all ages of almond moth eggs were equally susceptible to parasitism by Trichogramma evanescens. (I) Tifton, Ga. II-1-C

New Aziridinyl Compounds Synthesized. A number of new aziridinyl compounds for testing as insect chemosterilants were synthesized. (E) Univ. of Pa. II-1-C

Protection of Bees from Insecticides. An experimental motor vehicle with a hoist and other accessories facilitates handling bee colonies more rapidly in moving them away from areas of insecticide hazard. Various methods are being tested for confining bees within hives, including blowing air blasts across the entrance, use of audio and ultrasound, and methods for physical wrapping. Methods are also being investigated for "fencing" bees within

particular flight areas with some remote stimulus, such as "barriers" of radiant energy or sound. (I) Madison, Wisc., and Tucson, Ariz. II-1-C

Bee Sperm Sterilized in vitro. Bee sperm was treated experimentally in vitro with the insect chemosterilant tepa and used to inseminate virgin queens. A concentration of 25 nanograms of tepa per 3 microliters of sperm produced nearly 100% mortality of zygotes. (I) Beltsville, Md., and Tucson, Ariz. II-1-C

Extraction of Indian-Meal Moth Attractant. Quantitative bioassay indicated that the sex attractant can be extracted from Indian-meal moths with ethanol. Distillation and chromatography are being used in purification and isolation of the attractant. Although some attractant is lost during purification, enough is being isolated for identification. (E) University of Georgia, Athens, Ga. II-1-C

Electron Micrographs of Attractant Glands. Electron micrographs of the attractant glands in Indian-meal moths showed few cuticular pore canals. Surfaces of the gland epidermal cells adjacent to the endocuticle were microvillate. Lipid droplets were evident in the gland cells. (E) University of Georgia, Athens, Ga. II-1-C

Electron Microscope Studies Beetles. A cornicular sensillum on the antenna of all larval stages of the saw-toothed grain beetle was identified as a thin-walled chemoreceptor. Electron microscope study of this and surrounding sensilla suggests a primary olfactory guidance function for the cornicle.

The Savannah insectary strain of the red flour beetle has an apparently nonfunctional compound eye. Morphological studies have been started to determine the reason for the condition. No differences between blind and sighted beetles were found by light microscopy.

The ocellus of the black carpet beetle was observed to be closely associated with the medial neurosecretory centers of the brain. Further study will determine whether there is a functional relationship.

Electron micrographs indicate the eye of newly-emerged black carpet beetle females is not fully developed. (I) Savannah, Ga. II-1-C

Electron-Microscope Studies: Moths. Pronounced morphological changes have been observed in the midgut of Plodia larvae according to feeding state. A study is under way to determine whether these changes, which may result in larval death or premature pupation, are mediated through neurohumoral or direct neural action.

Work began on the classification of several types of receptors on the antenna of the Indian-meal moth. Electron micrographs have identified chemoreceptors believed responsible for detection of sex pheromone. (I) Savannah, Ga. II-1-C

Factors Affecting the Role of Microorganisms in the Biological Control of Insect Pests. Identification of the bacteria from the meconia of adult sawflies, though tentative, has been completed. Micrococcus flavus, Micrococcus sp., Brevibacterium quale, Brevibacterium sp. and Bacillus megaterium were obtained from female meconia and in addition to three of the above, both Micrococcus caseolyticus and Bacillus cereus were obtained from male meconia. Pathogenicity studies with the bacterial isolates against third instar Diprion similis larvae ranged from 16 to 63% with Micrococcus sp. and Brevibacterium sp. providing in excess of 40% mortality. Fungus isolates from meconia have been identified as Penicillium terlikowski, P. decumbens, P. janthenellum, P. frequentans, Pencillium sp., and Aspergillus flavus. Pathogenicity studies with the fungus isolates against third instar sawfly larvae, after correction by Abbott's formula, provided 11 to 50% mortality, except for A. flavus which provided 100% mortality. (E-fg) Wisconsin Agr. Exp. Sta. II-1-C

Green Peach Aphid Response to Light. Aphid locomotory responses to electromagnetic radiation were tested from 350 nm wavelength to 700 nm, using a small, 12" x 3", pentagonal test arena. Adult non-winged aphids exhibited a gradual decrease in response to a monochromatic diffused light source as wavelength increased. When non-winged and winged aphids were given a choice between diffused monochromatic light and diffused "white" light from a clear tungsten lamp, a sudden reversal of preference from monochromatic light to "white" light occurred for wavelengths of 600 nm and longer. This appears to agree with general observations that orange is attractive to aphids. In further tests infrared was filtered from the tungsten energy and no difference in response was noted between tests with, or without, infrared energy. (E) Purdue University. II-1-C

Grain Chilling. Saw-toothed grain beetles, Indian-meal moths, and almond moths did not reproduce when held at a temperature of 60° F.

After a 1- and 4-week exposure at 40° F., 30 and 100% mortality of red flour beetle adults, respectively, occurred. After a 4-week exposure at 50° F., 37% of the adults were dead. After 7 weeks' post exposure at 80° F., no progeny were found in media in which the adults had been held at 40° and 50° F. When the adults that were still living after exposure to the various temperatures were placed on new media the number of progeny from those initially exposed 1 week to 40°, 50°, and 60° F. was reduced. This may have been due either to mortality of the adults or exposure to the lowered temperatures. No progeny were found in the media in which the adults were held for 3 or 4 weeks at 60° F., and an average of only 11 and 25 progeny resulted from adults held for 1 and 2 weeks, respectively, at this temperature. (I) Savannah, Ga. II-1-C

Gamma-Ray Effects on Mites. Young copulating adult Acarus siro were exposed to gamma radiation. The females laid fewer eggs and hatching time increased as the radiation dose increased from 0 to 50 krads. Egg hatch averaged 9

days for controls and 16 days for irradiated mites. Egg production was reduced 50 and 95% for 5- and 50-krad treatments, respectively.

Introduction of males, previously subjected to 5 to 15 krads of radiation, into normal populations significantly reduced the numbers of all life stages. Females from the 5-krad treatment laid eggs earlier, and total numbers laid during the first 3½ weeks were greater than in the controls. Radiated males (15 krads) released in 10:1 ratio with normal males in an established colony produced no significant reduction in the population. (E) University of Georgia, Athens, Ga. II-1-C

Combined Treatments of Gamma Irradiation and of Insecticides. Tests to determine the effects of combined radiation and insecticide treatments have been initiated. Insects were irradiated for various lengths of time before treatment with insecticide. Preliminary results indicate a degree of antagonism when radiation is followed immediately by malathion treatment. At the lowest radiation dosage used, considerably more insects survived the insecticide treatments than survived the insecticide treatment without radiation.

Tests were made to determine the effect of radiation on residues of malathion applied to kraft paper. Two rates of application of malathion and seven radiation levels were used. Preliminary data indicated that the malathion was not significantly affected by the radiation. (I) Savannah, Ga. II-1-C

Gamma Irradiation of Insects. Irradiation of infested wheat flour and cornmeal at a dosage of 30 to 50 krads controlled eggs and young larvae of the red flour beetle, saw-toothed grain beetle, confused flour beetle, almond moth, and Indian-meal moth.

The red flour beetle, saw-toothed grain beetle, and yellow mealworm showed about the same radiation sensitivity as other beetle species that have been studied. The almond moth showed much higher sensitivity to radiation than the Indian-meal moth and Angoumois grain moth had shown in previous studies. (I) Savannah, Ga. II-1-C

Importation of Insect Parasites. Thirty-one species of parasites and predators of eleven different insect pests were collected in Europe and India for introduction into the United States for testing, evaluation, and actual use in biological control. All of these beneficial insects, over 86,000 specimens in 146 shipments, were received for screening and transshipment to liberation points or to various Federal and State field stations for evaluation or release. Over 75,000 specimens (in 305 consignments) of foreign or recently established parasites were released or made available to State or Federal laboratories in 26 states. (I) Moorestown, N. J. II-1-C

Attractants for Insects. Studies of several synthetic attractants for cabbage looper males revealed no compound as active as the female sex attractant. Four species of moths were found to possess and respond to the attractant. The presence of a sex attractant or pheromone in the Southwestern corn borer was verified. About 50 ug. of the attractant was isolated and limited information on its identity was obtained. Additional insects are being reared to produce sufficient attractant to determine its structure. Studies of sex pheromones in ticks were initiated. (E-fg) Alabama Agr. Exp. Sta.

II-1-C

Insect Attractants. A search to find predators with potential pheromones sufficiently powerful to manipulate field populations showed that Collops bipunctatus and C. vittatus (possibly nigritus) secrete pheromones from two pairs of eversible glands. The pheromones are not species specific since extracts from one species is attractive to the other. The chemoreceptor sites apparently are located on all but the proximal three antennal segments. Refinement of the crude extract and field testing will be attempted next year. Several species of Chrysopa are being studied at the present time. (E-fg) Colorado Agr. Exp. Sta.

II-1-C

Infectious Diseases of Insects in Hawaii. A mixed culture of Thelohania californica and Nosema lunatum, both microspordian pathogens of mosquitoes in California, were found to be slightly pathogenic to first and second instar Culex quinquefasciatus in Hawaii. All of the Hawaiian species of mosquitoes were not susceptible to the fungus Coelomomyces indicus, a pathogen of Anopheles gambiae. Laboratory tests with a commercial formulation of Heliothis virus revealed a significant number of the Heliothis larvae killed by the virus. Natural infections are almost never found in Hawaii. The fungus, Aspergillus parasiticus, were found to be highly pathogenic to and the main controlling factor for the sugar cane mealbugs on Kauai. No significant pathogens were found on the borer, Rhabdoscelus obscurus. Although Metarrhizium is reported to infect the borer, none were found killed by the fungus in the field. (E-fg) Hawaii Agr. Exper. Sta. II-1-C

Culture of Insect Pathogens. Study of factors favorable to insect cell growth in vitro were continued on Trichoplusia ni, the cabbage looper, and Malacosoma disstria, the forest tent caterpillar. A number of organs of Malacosoma were cultured. They sent out large numbers of cells which remained healthy and active for several weeks. Eye buds of Trichoplusia proceeded to differentiate by forming pigment. Malacosoma caterpillars were hatched from field-collected eggs and reared on artificial food in the lab, to complete the life cycle. The second generation eggs are in diapause. Nuclear polyhedrosis virus and Perezia microspordian parasites were collected from Malacosoma, purified and stored for infection experiments. Spumalin, the dark, hard insoluble protective material covering the egg masses of Malacosoma was collected while still in female accessory glands for biochemical analysis. (E-fg) Minnesota Agr. Exp. Sta.

II-1-C

Insect Responses to Infrared Radiation. In behavioral studies no responses of insects to infrared radiation have yet been observed nor have any infrared output signals between 2 and 20 microns from insects been measured. However, attraction to blacklight radiation, to currents of moist air, and to odor of female insects has been confirmed. Species tested were: Heliothis zea, corn earworm; Spodoptera frugiperda, fall armyworm; Plodia interpunctella, Indian-meal moth; and Ostrinia nubilalis, European corn borer. Measurements of the characteristics of physiological tissue indicate infrared transmission of the corneas of all three species of moths are essentially the same in the region of 1-15 microns. Transmission of antennae and sections of exoskeleton are similar to the corneas.

Measurement of the rate of evolution of carbon dioxide from insects has been demonstrated as an effective means for remotely evaluating stimulation of the insects. Active, or internally stimulated, insects evolve more CO₂ and cyclic patterns are evident. (E) University of Michigan, (I) Ames, Iowa.
II-1-C

Insect Spines as Detectors of Infrared Radiation. The possibility that insects sense infrared radiation through spines or other skeletal structures was further explored. The dielectric constant of insect exoskeletons has been measured and laser equipment is being developed to provide intense infrared sources. No insect response to infrared has yet been experimentally verified. (E) Georgia Institute of Technology.
II-1-C

Superior Japanese Beetle Attractant. Previous testing of many compounds as Japanese beetle attractants had shown that phenethyl butyrate was more effective than the attractants then in use for trapping this pest. Field testing of candidate attractants in F.Y. 1968 revealed that several esters of cyclohexanepropionic acid are considerably more effective than phenethyl butyrate. (I) Beltsville, Md.
II-1-C

Light Traps for Stored-Product Insects. A combination of green and ultraviolet light sources in light traps did not attract significantly more insects than did the individual sources. (I) Savannah, Ga.
II-1-C

Pathogens. Thirty-five pathogenic micro-organisms, including viruses, bacteria, protozoa, and nematodes, have been isolated from stored-product insects. Thirty of these are highly virulent to insects. Certain microsporidian pathogens are relatively host-specific, readily transmitted, and capable of causing high mortality. A new genus of 3 new species of nematodes have been isolated from dried-fruit beetles. These are new host records. The nematodes sterilize adult female beetles and produce high mortality.

A granulosis virus reduced the respiration rate of larvae of the Indian-meal moth. The virus was not effective against other moths tested. The virus was not affected by prolonged periods of 37° C. A formaldehyde egg wash was effective in suppressing the granulosis virus. Larvae exposed to the virus

before pupation did not transmit an observable infestation to the following generation. (I) Fresno, Calif. II-1-C

Parasite Behavior. Bracon hebetor Say, a braconid parasite, was reared in cultures of Indian-meal moth larvae. Addition of 2 adult pairs of the parasite wasps per 200 moth larvae reduced the host population markedly. Use of 7 pairs of wasps reduced the host population even further. Increasing the wasps to 12 pairs made only a slight further reduction in the moth larvae. Melechares tarsalis (Berlese), a predatory mite, was reared singly, and a complete life history determined at 75% R.H. and 25° C. (E) Clemson University, Clemson, S. C. II-1-C

Physical Resistance of Packages to Insect Penetration. Polypropylene/cellophane laminate packets were more resistant to insect invasion than were standard packets but did not prevent insect penetration. Tests with 50-pound bags made with various plies of spunbonded polyethylene and kraft paper showed that the multi-ply bags were more resistant to insect penetration than were single-ply spunbonded or conventional polyethylene bags. A multiwall paper shipping sack with a partly laminated polyethylene inner ply and pasted-open-mouth, stepped-end closures containing dry milk resisted infestation during 6 months' exposure to insects. (I) Savannah, Ga. II-1-C

Sex Attractants. The effect of radiation on the response of Indian-meal moth males to the female attractant was determined by exposing 3-day-old adults (approximately 25% survival of 8-day-old pupae irradiated with 50 Krad) to serial dilutions of extracts from nonirradiated females. Data showed that these males were as responsive and sensitive to the female attractant as were nonirradiated males. Females were irradiated at dosages of 10, 25, and 50 krad as 8-day-old pupae. Adult survivors of the 50-krad dose attracted considerably fewer males than did nonirradiated control females, but they released a material which was still attractive to virgin males. Less difference in attractiveness of treated and control females was observed at 25 krad, and essentially no difference was observed at 10 krad. (E) University of Georgia, Athens, Ga. II-1-C

Effect of Sounds on Insects. Reactions to sounds have been found in 4 species. Insects reacted even when shielded from substrate vibration. Cadra cautella and Tribolium confusum reacted consistently, but rather faintly, by jerking the tibiae. Attagenus megatoma and Sitophilus oryzae reacted vigorously by moving their legs and antennae. (E) University of Oklahoma, Norman, Okla. II-1-C

Indian-meal Moth - Sound Response. Indian-meal moths mounted on wires perceived sound between 2 and 90 kHz, as evidenced by starting or stopping of flight movements. The stimulus appeared to be mediated by the wire mounts, although free-flying moths took evasive action when tone bursts occurred.

The male's behavioral responses to the female pheromone were temporarily inhibited by high-intensity, high-frequency sounds from sources such as loudspeakers, police whistles, or bells. In virgin-female baited traps, the catches normally consisted mostly of male moths. However, 10 kHz sound reduced the ratio of male to female moths caught. (E) University of Georgia, Athens, Ga.

II-1-C

Production of Sound by Insects. Further extensive listening, recording, and electronic analysis have revealed no sound production by stored-product insects that could be shown to be of biological importance. (I) Savannah, Ga.

II-1-C

An aural method of detecting rice weevil infestation in wheat kernels was explored using piezoelectric transducers and high-gain audio amplifier. Preliminary data from single-kernel listening tests at 80° F., showed that a maximum listening time of 20 seconds per kernel yielded an infestation index that was 53% of the true value as determined by X-ray. Sonographic time-frequency-amplitude analyses revealed identifiable differences between larval and adult feeding sounds. Pupae produced a distinctive sound, but only when physically shocked. Under quiet listening conditions, larvae as early as the second instar were heard. In bulk-kernel listening tests, 1 adult-infested kernel in 800 uninfested kernels could be detected. Preference of single- or bulk-kernel approach will depend on the inspection objective (qualitative or quantitative), the confidence level requirements, and the desired time per test. (I) Savannah, Ga.

II-1-C

Response of Insects to Sound. Electrophysiological investigations with tobacco hornworm moths yielded no detectable evidence of response to sonic energy stimulations. Electrodes were placed in the cervical connective, antennal nerve, and Johnston's organ. Sonic treatments of 80 dB intensity ranged in frequency from 50 Hz to 100 KHz, pulsed at a rate of 10 pulses per second, and square-wave pulses, or "clicks," of 1-millisecond duration ranging from 1 to 100 pulses per second. Nerve responses were related more to elongation of an antenna than to deflection. Flight sounds of houseflies have been recorded and used as a stimulus, but no detectable response was obtained with flies. (E) Virginia Polytechnic Institute.

II-1-C

Spectral Sensitivities of Insects. Photoresponse of black carpet beetles in a multichoice phototaxis apparatus agreed in general with spectral sensitivities determined by electrophysiological methods. However, there was a response to red that suggests a receptor other than the eye. Electroretinograms showed the maximum sensitivity of most stored-product insects is in the green region of the spectrum, 5500 A to 5750 A. The maximum response of the black carpet beetle adult occurred at about 5250 A. In most insects tested, retinal sensitivity diminished rapidly above 6000 A, with virtually no response in the red region of the spectrum. Sex-related differences were observed in the visual response of several stored-product insect species. (I) Savannah, Ga.

II-1-C

Sterilization of the Wax Moth *Galleria mellonella* by Gamma Rays. Female wax moths are more susceptible than males to irradiation with gamma rays. Tests indicate that complete sterility can be obtained in both sexes and that a broad range exists between the sterility dosage and the nonmating or lethal dosage. When female pupae are treated with dosage even below 10,000 rads, egg production and viability is greatly reduced. Male adults from pupae treated with similar amounts and mated to normal females cause reduced viability but not reduced egg production. (I) Baton Rouge, La. II-1-C

Symbionts of Stored-Product Insects. In detailed studies of the internal anatomy of the black carpet beetle, no apparent structures for housing or aiding microbial symbionts were found. No intracellular forms were seen and no apparent mutualistic micro-organisms were present. The life cycle was determined for a protozoan common in the larva. The addition of sorbic acid to the diet of mated pairs of either the black carpet beetle or *Trogoderma parabile* at levels of 1.2-8% by weight during the full development of that generation resulted in failure of progeny to survive beyond the first larval instar. (E) University of Wisconsin, Madison, Wis. II-1-C

Heat Control of the Wax Moth *Galleria mellonella*. A controlled temperature of 120° F. for 2 hours has been found to be effective in killing all stages of the greater wax moth infesting honey comb and hive equipment. (I) Beltsville, Md. II-1-C

Allelopathy in Weeds. Extramural research at the Battelle Memorial Institute did not provide evidence that weeds secrete or exude chemicals inhibitory or stimulatory to the germination of seed or growth of plants of other species. (E) Columbus, Ohio. II-1-D

Beetle Feeding Stimulant. An unidentified feeding stimulant(s) for the chrysomelid beetle has been extracted from alligatorweed, a weed pest in irrigation canals and principal host of the chrysomelid beetle. (E) South Pasadena, Calif. II-1-D

Biological Control of Weeds and Poisonous Range Plants. New areas in the state were surveyed for Canada thistle infected with Root Rot. Many new diseased plants were found but isolations failed to yield cultures with more pathogenicity than those previously collected. New vegetative clones of Canada thistle were increased and specific pathological tests revealed that some pathogenic cultures lost their ability to produce severe disease symptoms after storage in vitro over a period of time. (E-fg) Wyo. Agr. Exp. Sta. II-1-D

Macartney Rose. Mowing Macartney rose (*Rosa bracteata*), in Texas, in July or October significantly reduced ground cover the following spring. When mowed in May, the ground cover of Macartney rose did not differ significantly from unmowed plants a year after mowing. Mowing in May or October did not change the amount of tops killed by picloram treatments but mowing in July

reduced the amount of tops killed. Mowing in May significantly increased tops killed and decreased ground cover of Macartney rose when it was subsequently treated with 2,4-D. (I) College Station, Texas. II-1-D

Physiological and Biochemical Mechanisms of Selectivity of Herbicides.

Annual morning glory, a serious weed in Maryland soybean production, is susceptible to chloroxuron while soybean is resistant. Radioactive chloroxuron-C¹⁴ was used to study the uptake and metabolism of this herbicide by both species. Postemergence selectivity is due primarily to differential penetration to the site of toxic action. A much higher concentration of chloroxuron-C¹⁴ was found in chloroplasts isolated from morning glory than from soybean. This is important since chloroxuron is a powerful inhibitor of photosynthesis. With preemergence applications of chloroxuron, selectivity is a result of differential translocation. In soybean plants most of the chloroxuron was bound in the roots, thus preventing accumulation at the site of action in the chloroplasts. However, large quantities of herbicide did move from morning glory roots to shoots. (E-fg) Md. Agr. Exp. Sta. II-1-D

Biological and Cultural Control of Nematodes. At Beltsville, Maryland, a soil flatworm reduced the incidence of free-living soil nematodes and root-knot nematodes in greenhouse and in vitro tests, but it was not judged to have great potential for practical control of plant-parasite nematodes under field conditions. The fungus Catenaria sp. was weakly parasitic to foliar, root-knot, and cyst nematodes, but on the free-living nematodes it was highly parasitic. (I) Beltsville, Md. II-1-F

Biological Significance of Plant-Parasitic and Predaceous Nematodes. Four species of soil-borne mycophagous nematodes exhibited "preferences" among nine species of soil fungi. When given equal and simultaneous access to all fungi and a control, each nematode species responded in a consistent and characteristic manner. The numbers of nematodes that accumulated around all fungi except Epicoccum nigrum differed significantly (1%) from the control. (E-fg) Ill. Agr. Exp. Sta. II-1-F

Identification of Components from Amended Soils which Reduce Nematode Populations. Research at the University of California, Riverside, indicated that an isolate of Aspergillus niger, obtained from cellulose amended soil, produced enough oxalic acid in vitro after a short incubation period to reduce populations of free-living nonparasitic soil nematodes, which are normally tolerant of microbial metabolites and even nematocides. Tests with fertilizers indicate that NH₃ and NH₄ components reduced infestations of root-knot nematodes. (E) Riverside, Calif. II-1-F

Nematodes in Crop Rotations. Long-term rotation studies of cultivated crops and sod base rotations continue to show that proper selection of rotation sequences can prevent buildup of damaging populations of nematodes in Georgia. Such crops as Hairy Indigo, beggarweed, Crotalaria, and marigolds reduce numbers of both ectoparasitic nematodes (such as sting and stubby-root) and endoparasites (such as lesion and root-knot). Many grasses such

as Coastal bermuda and fescue control root-knot nematodes, but greatly increase damaging populations of ectoparasitic nematodes. Other grasses such as millet and sudangrass increase root-knot and certain ectoparasitic nematodes.

(I) Tifton, Ga.

II-1-F

Sting Nematode Control with Soil Amendments. The sting nematode (Belonolaimus longicaudatus) was effectively controlled in soils to which certain organic amendments were added. Alfalfa and cotton seed meal at 8-tons per acre each controlled this nematode until the plants matured and were harvested. More fungal colonies were produced in soil amended with alfalfa meal than in soil with cotton seed meal. It has not been determined positively whether organic amendments control nematodes through indirect effects on micro-organism activity in soil. (I) Gainesville, Fla.

II-1-F

Animals

Attraction of House Flies to Lights. House fly response to traps utilizing light attractants is affected by air temperature, elevation of the traps and the color of light. UV lamps in warm barns ($>24^{\circ}\text{C}$) attracted about 3.5 times as many flies as did green and 12 times that by orange lamps. Nearly twice as many males were caught in traps 2 meters as in traps 0.6 meters above the floor. (I) Beltsville, Md.

II-21-C

Biological Control of Mosquitoes. A nematode, Romanomermis invaded and developed in 25 species of mosquitoes of seven genera either in the laboratory or in the field. Also, a mermithid nematode was found infecting over 20 percent of the adult Aedes sollicitans collected in southeastern Louisiana in 1967. A pathogenic fungus Entomophthora coronata has been isolated from Culex quinquefasciatus mosquitoes. Also, the mosquito iridescent virus, Coelomomyces and microsporidia have been found infecting several species of mosquitoes. (I) Lake Charles, La.

II-21-C

Chemosterilization Studies with House Flies. House flies were sterilized by allowing the emerging flies to crawl through tepa treated strands of styrofoam. Flies thus exposed were effectively sterilized and competed very well with untreated flies for mates. (I) Gainesville, Fla.

II-21-C

Heterotylenchus autumnalis Parasite Increased in Face Fly Colony. Reduction of the amount of manure for a given number of face fly larvae increased the incidence of infection of face flies with the nematode parasite, Heterotylenchus autumnalis from 25-35% to 67-82%. (I) Lincoln, Nebr.

II-21-C

Parasites of the Face Fly. A colony of the larval parasite Aphaereta pallipes capable of reproduction in and emergence from face fly puparia has been

established in the laboratory and is in the 15th generation. The host Alysia sp. (formerly thought to be ridibunda) has been determined to be the larva of a species of Ravinnia occurring in field manure concurrently with face fly larvae. The preliminary investigations of Aleochara tristis (imported French beetle parasite of the face fly) have been concluded with the findings that the parasite, because of limited searching capacity as a larva, showed little promise as a potential control agent for the face fly. Predation by the beetle was also considered too low to warrant further study. (E-fg)
Missouri Agr. Exp. Sta.

II-21-C

Insect Pheromone Isolation. The sex attractant of T. inclusum was isolated by the following procedure: benzene extraction, distillation, sodium bicarbonate extraction, low temperature precipitation, silica gel chromatography, and gas-liquid chromatography. Fifty thousand processed females yielded 0.3 mg. of active material. Isolation of the sex attractant of T. glabrum is proceeding along the same route. Preliminary work indicated that the attractant material is similar to that of T. inclusum. (E) Stanford Research Institute, Menlo Park, Calif.

II-21-C

Insect Pheromone and Isomers Tested. Further laboratory tests were conducted with the synthesized sex attractant of the black carpet beetle, trans-3, cis-5-tetradecadienoic acid. As little as 0.0001 ug of the synthetic compound elicited responses by male insects. The other three isomers (cis-3, trans-5; cis-cis; and trans-trans) were synthesized. These were less active than the trans-3, cis-5 compounds. More importantly, their presence in a mixture did not interfere with the activity of the trans-3, cis-5 compound, which means that a practical large-scale synthesis should be possible since the difficult separation of isomers is not necessary. One sequence for large-scale synthesis of the synthetic material is under investigation. (E) Stanford Research Institute, Menlo Park, Calif.

II-21-C

Insect Pheromone Tested in Field. The synthetic black carpet beetle sex attractant, trans-3, cis-5-tetradecadienoic acid, was tested under field conditions. Preliminary tests indicate the attractant, which is relatively stable, was effective for several days over short distances when used alone or over greater distances when used in combination with air circulation or a black-light. The attractant showed good stability in deep-freeze storage. (I) Madison, Wis.

II-21-C

Organoboron Insect Chemosterilants. A series of organoboron compounds were synthesized for testing as insect chemosterilants. A number of them showed appreciable sterilant activity in screw-worms, Cochliomyia hominivorax. Their action was correlated with their hydrolytic stability and boric acid was identified as the active component in this type of chemosterilant. (I) Beltsville, Md., and Mission, Tex.

II-21-C

Physiological Control of Insects. The efficacy of antivitamin in suppressing weight increase, food uptake, and excretion of hide beetle larvae was greatest with 3-acetylpyridine, less with neopyrithiamine and aminopterine, and least with 4-deoxypyridoxine. The effect on food use was less in young larvae than in older larvae. Except for 3-acetylpyridine, responses were similar when the same substances were fed to black carpet beetle larvae. This material as well as farnesol and saponin markedly suppressed food consumption.

Attempts were made to counteract incorporation of nutrients in the ovaries by injection of nutrition antagonists into pupae and newly emerged adults. When application was made before ovarian development, egg laying was greatly inhibited by saponin and to a lesser degree with imidazole.

Hide beetle larvae were grown individually and newly emerged beetles were placed in pairs on diets containing known antagonists of pyrimidines, purines, amino acids, sterols, and vitamins, as well as several antibiotics and toxicants, to determine the effects on development and reproduction. The action of vitamin overdoses on the hide beetle varied with the life stage. No detrimental effect on larvae was observed from overdoses of nicotinic, pantothenic, or folic acid, or of pyridoxine, biotin, thiamine, riboflavine, choline chloride, or inositol. Overdoses of biotin to adult hide beetles were extremely detrimental. The F₁ generation died out as 1st-instar larvae. (P.L. 480) Hebrew University of Jerusalem, Jerusalem, Israel.

II-21-C

Resistance of Fabrics to Mosquito Bites. Of several fabrics tested, a North Vietnamese black cotton twill provided the most protection from mosquito bites followed by a U.S. material identified as Byrd cloth. Air permeability of the fabric and number of mosquito bites were well correlated. (I) Gainesville, Fla.

II-21-C

Infection of Cattle with One Species of Nematode May Limit Infections with Other Species. In limited trials calves infected with the hair-stomach worm, Trichostrongylus axei, did not develop as heavy an infection with the intestinal roundworm, Cooperia oncophora, as did calves not infected with T. axei. Perhaps by infecting cattle with relatively harmless species protection can be developed against infection with the more pathogenic ones. (I) Beltsville, Md.

II-22/23-E

Attraction of Cheese Constituents to Insects. The biological significance of the constituents of cheese that attract insects is under study. Minute amounts of a cheese constituent that attracts the cheese mite have been extracted. Attractivity was concentrated in the neutral, noncarbonyl, and alcoholic fraction, from which a 3,5-dinitrobenzoate derivative of the attractant was isolated. Lyophilization of the cheese may yield greater quantities of attractant. (P.L. 480) Tokyo University of Agriculture, Tokyo, Japan.

II-23-C

Control of Flies Through Improved Sanitation. An improved general sanitation program that eliminates fly breeding areas in and around barns can reduce the fly population on dairy farms by 50% or more. The continuation of such a program has accumulative effects throughout the year. In addition to large reduction in numbers of flies produced on a farm when major breeding sites are eliminated, the general farm area appears to attract fewer flies migrating from other farms or major breeding sites. (I) Beltsville, Md. II-23-C

Nonchemical Control of Flies. Laboratory tests of response of houseflies to particular radiation wavelengths indicate effects from temperature, sex, and height of trap, but field tests gave contradictory results. Orange was more effective than ultraviolet at cool temperature in the lab, but orange was ineffective in barns during cool fall weather.

Numerous observations were made of the behavior of houseflies in the vicinity of attractant lamps endeavoring to improve trap components and trapping procedures including effects of trap height, ambient light, lack of food or water, etc. Tests of these principles in barns are in progress. (I) Beltsville, Md. II-23-C

Parasites Attenuated in Wild-life Studied as Cattle Vaccine. Strains of lungworm parasites occurring naturally in wild elk have been recovered for evaluation as vaccines in cattle. The parasite produces little or no evidence of disease in cattle but does cause disease in elk. Preliminary studies of the immunity produced by the parasite in cattle are encouraging. Further studies are in progress to determine the most effective dosage, the routes of administration and age of animal to be vaccinated. (E-fg) Montana Agr. Exp. Sta. II-23-E

Poultry Lice Controlled by *Bacillus thuringiensis*. Dusts containing *Bacillus thuringiensis* when applied directly to the bird or made available in the litter eliminated infestations of lice on poultry in 14 to 28 days. (I) Kerrville, Tex. II-24-C

Blackhead of Poultry. Work on biological control has yielded evidence that ring-necked pheasants may be an important factor in the dissemination of histomonads, the causal agent of blackhead, and the poultry cecal worm, the vector of this agent. Pheasants are practically as resistant to blackhead as are most breeds of chickens, and the cecal worm thrives almost as well in pheasants as in chickens. Chukar partridges proved so susceptible to blackhead as to be considered unimportant in the dissemination of the disease agent and its vector. Bobwhite quail, poor hosts for the two parasites, probably are unimportant in their dissemination. (I) Beltsville, Md. II-24-E

Control Insects Without Chemicals. Four types of swine housing and waste disposal were studied: Type (A) an open-front, shed-type house with concrete floored front; types (B) and (C) enclosed houses with partially slotted floors over pits, but with different methods of waste disposal; and type (D) an enclosed house with total floor slotted over lagoon. In the type (A) house, the manure and bedding were removed weekly; in the type (B) house, the waste was discharged into a holding tank and later spread on adjacent land; in the type (D) house, the waste was discharged into a lagoon outside the house. Fly populations in type (B) and (C) houses were lower than those in type (D) and (A). Mosquito larvae were found in the unscreened lagoons of the type (D) house, but no larvae survived in the septic tank lagoon of the type (B) house. (E) Lafayette, Ind. II-25-C

Experimental Lamb Production. Trials of ways to produce lambs free of parasites and other pathogens indicated that the newly-born animals may be left with the dams for up to 24 hours after birth, with reasonable safety from parasite infections, if strict isolation and sanitary procedures are employed thereafter. Lambs left with ewes for 24 hours and then reared on an artificial diet under rigid conditions of sanitation and in strict isolation remained parasite-free and grew practically as well as those reared by ewes. Moreover, fewer deaths occurred among the former than among the latter. Using Dorset ewes bred in October or January, the numbers of pregnancies and multiple births were greatest in the October breedings. (I) Beltsville, Md. II-26-E

Vaccine Studies for Parasite Control. Antibody levels occurring following administration of parasites as vaccines were evaluated as a possible means for detecting levels of immunity produced. Statistically significant antibody levels were not found in lambs following two doses of irradiated vaccine. These levels were significant in vaccinates and controls after challenge. No relationship was found between vaccinates resistant at challenge and the antibody levels. (E-fg) Oregon Agr. Exp. Sta. II-26-E

Field Crops

French Strain of *Bacillus thuringiensis*. Of several biopreparations of the disease organism *Bacillus thuringiensis* tested against the Mediterranean flour moth, the "Anduze" strain from France was most effective. (P.L. 480) University of Zagreb, Zagreb, Yugoslavia II-31-C

Cereal Leaf Beetle Parasites. Over 700 *Oulema* eggs parasitized by the hymenopterid *Anaphes flavipes* were collected this year in France, Germany, Austria, Hungary, and Rumania, and sent to the United States. European collections of this egg parasite for release against the cereal leaf beetle, *Oulema melanopus*, in the U.S. have been underway since 1965. This spring, *A. flavipes* was recovered in several Michigan grain fields, several miles from previous release sites, indicating that the parasite is established in the U.S. Efforts are continuing to establish the three known larval parasites of *O. melanopus*-*Tetrastichus julis*, *Lemophagus curtus*, and "*Tersilochus*" *carinifer*. Over 25,000 *Oulema* pupal cells containing these parasites and nearly 800 adult parasites were sent to the U.S. this year from collections in Portugal, Spain, Italy, Rumania, Yugoslavia, France, Denmark, and Sweden. (I) Gif-sur-Yvette, France. II-31-C

Host Specificity in Cereal Grains and Legumes. Substances in cereal and legume seeds attractive to rice weevils and cowpea weevils, respectively, were found to be water soluble. No repellents for the rice weevil were found in legume seeds, and none for the cowpea weevil were found in cereal seeds. The egg-laying habits of the cowpea weevil were not affected by extracts of legume seeds applied to pea seeds, lima bean seeds, or cereal seeds. (E) Shaw University, Raleigh, N. C. II-31-C

Khapra Beetle Pheromone. Histological study of female khapra beetle adults revealed that groups of ectodermal cells under the last abdominal sclerites near the ovipositor closely resemble glands that excrete attractive substances in Lepidoptera. Extracts of pheromones from virgin males and females of 3 ages were evaluated for attraction. If attraction is proportional to concentrations of pheromone, excretion of pheromone appears to increase with age of adults. In studies of cross-species attraction, *Trogoderma granarium* pheromone repelled *Tenebrio molitor*, *Tribolium castaneum*, *Dermestes maculatus*, and *Oryzaephilus surinamensis*, but attracted *Callosobruchus maculatus*. Pheromone from *T. molitor* attracted *T. granarium*. (P L. 480) Hebrew University of Jerusalem, Jerusalem, Israel. II-31-C

Insect Pheromone Not Specific. Interspecies testing among several Trogoderma species indicated that T. inclusum and T. glabrum responded to an extract of T. granarium (khapra beetle) females. In preliminary tests in Israel the males of T. granarium responded to the extracts of female T. inclusum and T. glabrum. The khapra beetle males responded faster to the T. inclusum extracts than they did to extracts of khapra beetle females. (I) Madison, Wis. II-31-C

Insect Resistance of Crop Plants. Studies with the spotted alfalfa aphid, Therioaphis maculata, have shown that the tolerance component of resistance in alfalfa is inherited separately from the other two components and is a valuable part of resistance to this aphid. Resistance to Acyrtosiphon pisum in alfalfa is strongly influenced by the environment and the substance responsible for resistance passes through a graft union from scion to stock. Many of the wheat lines being used for sterile and restorer lines in hybrid wheat production have Hessian fly resistance. Some corn lines and populations continue to show a small amount of resistance to infestation and to girdling by Zeadiatraea grandiosella (Dyar). (E-fg) Kansas Agr. Exp. Sta. II-31-C

Radiofrequency Treatment to Control Grain Insects. Radiofrequency (RF) electrical treatment of infested grain can control all developmental stages of all species of stored-grain insects tested thus far. Insect control can be achieved by treatments which do not damage wheat germination nor its milling and baking qualities, but costs of the electrical treatment are estimated to exceed those of chemical control methods. Therefore, studies are aimed at improving the efficiency of the RF control method. Work this year has dealt mainly with the development of methods for measuring the relative RF dielectric properties of insects and grain. This information is necessary to determine the most effective frequencies to employ for insect control treatment of infested grain. (I) Lincoln, Nebr. II-31-C

Mechanical Methods of Weed Control. Soil types, moisture-density conditions, root density and distribution, and root fixation in soil were studied for their effects on shearing action on the soil and on the roots and rhizomes of weeds. Results indicate that root cutting can be effective only when roots are fixed in the soil. A compacting device operating ahead of the cutting blade is being studied. (P.L.-480) Volcani Institute of Agricultural Research, Beit Dagan, Israel. II-31-D

Weed Responses to Environment. In plant competition studies, the suppression of giant foxtail and redroot pigweed by an overstory of corn was much greater under fluorescent lights than under sunlight in June. Therefore, the use of data from light competition studies conducted under fluorescent lights to gain an understanding of plant competition in sunlight may not be feasible. Pretreatment temperature and humidity have little influence on the response of wild buckwheat to dicamba. High posttreatment humidity caused the greatest dicamba injury to wild buckwheat. Studies on the length of post-treatment exposure indicate that plants held at a high temperature and

humidity for six days before transfer to a lower temperature and humidity were injured as much as plants held continuously at the high temperature and humidity. (E-fg) Minn. Agr. Exp. Sta.

II-31-D

Bionomics of Cereal Leaf Beetle. The amount of damage and loss due to the cereal leaf beetle has been quantitated to ascertain economic levels of infestation. Survey techniques used in 1967 gave a clearer picture of the build-up of the cereal leaf beetle in areas where it has dispersed. The build-up is taking place very rapidly. Biological research has been quantitated into life tables which facilitate practical measures towards control and serve as a basis for research toward more satisfactory means of suppressing the pest. Data acquired to date afford promise that parasites, if they can successfully overwinter, show promise as a biological controlling mechanism in the regulation of cereal leaf beetle abundance. (E-fg) Indiana Agr. Exp. Sta.

II-32-C

Host-Plant Resistance to Spider Mites. A study on resistance of inbred lines to spider mites shows that at least two lines have some resistance or are able to escape major mite damage. Erectness of leaves, plant height and maturity appear to be partial factors involved. Tests involving corn hybrids with various lengths of maturity indicate that longer maturing hybrids combined with later planting dates reduce mite damage. (E-fg) Colorado Agr. Exp. Sta.

II-32-C

Light and Food Preferences of Mites in Stored Grain. A broad spectrum of light colors and intensities has been used in preference tests with the two species of Acarus and other graminivorous mites. Light in the violet range was found to be less disturbing to the mites than were lights of red, green or blue values. Tests in a light-dark chamber have shown that complete darkness is more attractive to test organisms than any color of the spectrum. Various processed and natural grains and grain derivatives have been used in food preference tests with Acarus siro and A. farris, to establish optimum substrates for dispersal experiments. Results indicate that A. siro prefers processed grain materials, while A. farris is somewhat more attracted to natural unprocessed foods. (E-fg) Oregon Agr. Exp. Sta.

II-32-C

Mite Control on Corn and Sorghum. The fourth year of a study on resistance of inbred lines to spider mites continues to show that at least two lines have some resistance or are able to escape major mite damage. Erectness of leaves, plant height and maturity appear to be partial factors involved. (E-fg) Colorado Agr. Exp. Sta.

II-32-C

New Resistant Wheat Varieties Released. Stripe rust and bunt resistance are found in Crest, released with Montana Agricultural Experiment Station, and Adams, released with Oregon. Released cooperatively with Minnesota was Polk. Polk, besides having a broad base for stem rust resistance, also

has excellent test weight and milling qualities. (I) Bozeman, Mont., Corvallis, Oreg., and St. Paul, Minn. II-321-B

A Smut Resistant Spring Wheat Released. For the Pacific Northwest, a new hard white spring wheat variety was developed by the Oregon Agricultural Experiment Station and the Crops Research Division. This variety, Adams, has excellent milling qualities and is highly resistant to most known races of common bunt (covered smut). It also appears to possess some tolerance to stripe rust. (I) Corvallis, Oreg. II-321-B

Wheat Varieties for Nebraska. Foundation seed of 2 new Nebraska wheat varieties Guide (C.I. 13856) and Scout 66 (C.I. 13996) was distributed to growers in 1967. Both combine superior performance with stem rust resistance and good quality and are valuable additions to varieties available to Nebraska wheat producers. (E-fg) Nebraska Agr. Exp. Sta. II-321-B

Insect-Resistance in Wheat Varieties. Brown wheat mite populations were higher on fertilized than on non-fertilized wheat. Initial crosses were made between a greenbug resistance source and Parker, Triumph 64 and Kaw wheats. Further selection of greenbug resistant rye derived from variety Caribou has resulted in a line having 97% resistant plants. Wheat x greenbug resistant rye F (1)s were resistant but sterile; attempted backcrosses to wheat were unsuccessful. There has been a decided increase in Hessian fly populations in North Central and Western Kansas. This follows the shifting to planting wheat varieties that are not resistant. Parasitism of the fly has also increased which somewhat counteracts this trend. (E-fg) Kansas Agr. Exp. Sta. II-321-C

Cereal Leaf Beetle Resistance in Wheat Makes Progress. High levels of resistance were noted in four common wheats and several tetraploids. Crosses between commercial varieties and resistant forms give promise of considerable protection to both winter and spring wheats. Pubescence on leaves continues to be one mechanism for resistance but probably is not the only one. It has been determined in Michigan that a dense covering of hairs on the leaves retards feeding by the beetle and possibly the laying of eggs. (I) Lafayette, Ind., Fargo, N. Dak., and Brookings. S. Dak., and (E) Michigan Agricultural Experiment Station. II-321-C

Two New Races of Hessian Fly Identified. Two new races of Hessian fly have been identified making a total of 7 races now available for genetic studies and as tools to evaluate wheats for resistance. Race E was identified from a sample of Hessian fly collected from a Georgia population. Race F, not yet identified in field populations, was developed by crossing Great Plains race females with Race C males and selecting surviving progenies when placed on certain resistant wheats. (I) Lafayette, Ind. II-321-C

Insect Resistance in Wheat. About 700 varieties of wheat from the World Collection were screened in India for resistance to rice weevils. Fewer than 5 weevils per test sample emerged from 2.6% of the varieties. Of 745 varieties tested against lesser grain borers, 4.8% showed resistance to attack. Of varieties screened against both species, 6 were resistant to both. (P.L. 480) Indian Agricultural Research Institute, New Delhi, India.

II-321-C

Genetic Improvement of Barley. Jefferson winter barley was released to Indiana seedsmen and to the Kentucky and Virginia Experiment Stations for their distribution. This provides an awnless counterpart of the recently released outstanding, but awned, Harrison. These two varieties represent an improvement in nearly every characteristic of winter barley over varieties previously available in Indiana. They are particularly outstanding for both pre- and post-ripening straw strength and are high yielding, high test weight, and resistant to powdery mildew, scale, leaf rust, and net blotch. Three of the newer lines incorporating high yield and stiff straw with greater winter hardiness were selected in 1967 for increasing. Additional crosses and selections were made to provide new combinations incorporating larger seed size, shorter straw, earlier maturity, additional winter hardiness, resistance to loose smut and spot blotch, and additional resistance to leaf rust and net blotch into the current best-adapted experimental lines. (E-fg) Ind. Agr. Exp. Sta.

II-322-B

New Resistant Barleys. Jefferson, a winter barley, was released cooperatively with Purdue University, Agricultural Experiment Station. It is resistant to leaf rust, powdery mildew, and scald, and moderately resistant to net blotch. It also is winterhardy and has exceptional post-ripening standing ability. Because it is almost without awns, it is easy to thresh.

Miller, also a winter feed barley, was released with Georgia Agricultural Experiment Station. It was developed specifically to provide resistance to leaf rust and powdery mildew for barley grown in the Upper Coastal Plain and Piedmont areas of Georgia. (I) Lafayette, Ind., and Tifton, Ga.

II-322-B

Development of Improved Varieties of Oats. Twelve monosomics, 1, 2, 3, 4, 5, 6, 7, (genome A) 14, 15, 18, 19, 20, and 21 (genomes C and D) have been identified in Avena sativa. The new tetraploid with high protein percentage (A. magna) has close genome homology to A. sterilis. Mutations for tolerant reaction to oat crown rust were induced by chemical mutagens. Crown rust spore concentrations in the atmosphere near pure line and multiline oat varieties showed that the latter reduced the rate of rust development and prevented an epiphytotic. The degrees of resistance conditioned by genes Pg-1 or pg-8 to certain stem rust cultures were proportional to the incident light that the oat plants received. The most sensitive growth period of oats to excessive heat is anthesis. (E-fg) Iowa Agr. Exp. Sta.

II-323-B

A Leaf Rust Resistant Oats Released. For the south Texas and adjoining areas along the Gulf Coast, a new variety of oats was developed with the Texas Agricultural Experiment Station. This variety, which is called Coronado, is superior in resistance to leaf rust and has strong straw which resist lodging. It was officially released to seed producers on March 15, 1968. Because of its outstanding rust resistance and good yielding ability, Coronado should be a valuable variety for the South and into the south-central Texas oat production areas. (I) College Station, Tex. II-323-B

Multiline Oats for Rust Resistance. Two oat lines have been developed and released with Iowa Agricultural Experiment Station for use in the north-central region. They were developed especially to provide longer lasting resistance to crown rust and to delay the onset of epidemics. These lines are the result of a new concept in oat breeding which promises better crown rust resistance. The two oat lines were made by compositing isogenic or near isogenic lines to form multilines, and are designated as Multiline M68 and Multiline E68. Both carry A and B genes for reaction to stem rust which condition resistance to races 6, 7, 7A, and 8. Both are heterogeneous to crown rust, their components having expressed differential reactions to 13 prevalent crown rust races. (I) Ames, Iowa. II-323-B

An Oat Variety Tolerant to Barley Yellow Dwarf Virus (BYDV). A new oat variety, Pettis, was released in January 1968, with good resistance to barley yellow dwarf virus. This virus is the number 1 oat disease problem. Pettis is a spring oat which was developed cooperatively by Crops Research Division and with Missouri Agricultural Experiment Station, and is suitable for States of the north-central region. (I) Columbia, Mo. II-323-B

Resistance to *Helminthosporium avenae* found. In a Quincy, Florida nursery, three selections of oats were found which express resistance to both phases (leaf blight and stem rot) of the disease caused by this fungus. These three lines are being incorporated into oat varieties suitable for the Southeastern United States where *H. avenae* causes the most damage. Tests have revealed that pathogenic strains of the fungus are prevalent in Florida. (I) Gainesville, Fla. II-323-B

Attraction of Rice Constituents to Insects. The biological significance of the constituents of rice that attract insects is under investigation. A component of polished rice attractive to the rice weevil appears to be an acidic substance of carboxylic nature that is soluble in water. Attempts to isolate the substance have not succeeded. (P.L. 480) Tokyo University of Agriculture, Tokyo, Japan. II-324-C

Inheritance of Resistance to Maize Dwarf Mosaic Virus. It has been shown that resistance to Maize Dwarf Mosaic Virus (MDMV) in the cross Oh07 (resistant) x C103 (susceptible) was largely controlled by two dominant genes. That additional minor genes for resistance exist, some of which are contributed by C103, is suggested by the fact that C103 can be converted by appropriate backcross methods to a line more resistant than Oh07.

When Oh07 is crossed with other susceptible corn lines, progeny lines may behave differently. In the case of inbred Oh43, a susceptible line which contributes minor genes for susceptibility, it would be difficult by back-crossing and selfing to obtain a converted Oh43 which would have as high a degree of resistance to MDMV as the Oh07 parent. (I) Wooster, Ohio.

II-326-B

Resistant Corn Inbred Lines for Virus Disease Control. A new inbred line, Oh514, resistant to maize dwarf mosaic virus (MDMV) has been developed and released cooperatively with the Ohio Agricultural Experiment Station. Oh514 resembles B14, which is a yellow endosperm inbred line used widely in mid-western corn hybrids. With the Missouri Agricultural Experiment Station, a white endosperm inbred line has been released mainly for its high tolerance to MDMV in Missouri, Mississippi, Ohio, and Tennessee and to corn stunt in Mississippi. This is Mol8W with a maturity similar to that of the well known Mol4W. (I) Wooster, Ohio, and Columbia, Mo.

II-326-B

Biological Control of Root-Infecting Fungi. Two microorganisms, Bacillus subtilis and Chaetomium globosum, isolated from soil were effective in controlling seedling blight of corn in greenhouse and field tests. Adding fungus to corn kernels was more effective than adding fungus to straw in the soil. Also, an extract from the fungus was a good seed treatment but not as effective as coating seed with the fungus; both improved emergence of seedlings, but the fungus protected seedlings from disease after emergence. The performance of the extract was comparable to performance of fungicides captan and thiram. The antagonistic organisms could be established in the rhizosphere of corn seedlings and apparently be effective in this root zone. (E-fg) Minn. Agr. Exp. Sta.

II-326-B

Breeding and Selecting Corn for Virus Resistance and Improved Agronomic Characteristics. Nine corn inbred lines were released for distribution in 1967. Three of the lines, Ky 128, Ky 222 and Ky 226, possess a high level of resistance to maize dwarf mosaic virus. Evaluations of commercial hybrids available to Kentucky farmers were conducted at four locations in the State. One location was specifically selected for maize dwarf mosaic virus infestation. Evaluations of progress in mass selection and reciprocal recurrent selection programs will determine possible continuance of these selection programs. Future breeding and genetic studies will concern the physiological and biochemical basis for yield and chemical composition as well as continued breeding for resistance to maize dwarf mosaic virus. (E-fg) Ky. Agr. Exp. Sta.

II-326-B

Corn Lines Resistant to Insect Attacks. Two corn lines have been released with resistance to insects. B68 is resistant to the European corn borer and possesses some resistance to northern leaf blight (Helminthosporium turcicum). B67 is moderately resistant to the western corn rootworm. (I) Ames, Iowa.

II-326-C

Early Fall Removal of Corn Silage Reduces Damage by Corn Rootworm. In a three-year study, cutting corn for silage by September 1 resulted in fewer rootworms and higher crop yields the following year. Yield increases varied from 11.0 to 12.2 bushels per acre. (I) Brookings, S. Dak. II-326-C

Ecology of Insect Abundance and Damage. The study on the effects of sugar spray on predatory insects and corn borer on corn was repeated. Results show that sugar and molasses both increased some predatory insect populations, and reduced corn borer infestation. Application of manure in corn fields reduced corn rootworm population. This reduction may be related to the increase in predatory mites in such plots. The distribution of Coccinellids in bean fields shows that weeds in the field supported Coccinellid larval population which later emerged as adults and moved on to beans. (E-fg) Minnesota Agr. Exp. Sta. II-326-C

Equipment for Mass Rearing of Insects. Equipment was developed to mechanize removal of fall armyworm larvae from rearing containers. Oviposition cages for corn earworm moths were improved to reduce labor in the mass rearing operation. (I) Tifton, Ga. II-326-C

Resistance to European and Southwestern Corn Borers. In studies conducted in Iowa, resistance to first generation leaf feeding by the European corn borer has been associated with a cyclic hydroxamate, the compound DIMBOA (2,4-dihydroxy-7-methoxy-1,4-benzoxazine-3-one). The biosynthetic pathway of this and related materials and the nature of inheritance are being investigated under a grant. Recurrent selection has been established as an effective procedure for increasing the level of resistance in breeding populations. Limited tests conducted in Mississippi, involving artificial infestation with southwestern corn borer egg masses, have failed to reveal any important differences in resistance to this important pest. These tests indicate, however, that the genes for resistance to southwestern corn borer are different from those conditioning resistance to the first and second brood of European corn borer. (Coop with ENT) (I) State College, Miss., and (E) Iowa Agr. Exp. Sta. II-326-C

Silks Can be Tested for Corn Earworm Resistance. In studying the nature of resistance to the corn earworm, improved techniques are being developed for detecting growth stimulators, suppressors, or toxins in silks which affect earworm larvae. A diet-dip bioassay technique was devised whereby limited amounts of silks can be effectively tested. Related studies on inheritance are conducted at the Southern Grain Insects Research Laboratory at Tifton, Georgia. Recurrent selection has been effective in increasing the average level of resistance. In the tests at Tifton, a corn earworm resistant line, 245, was found to carry genes for resistance on chromosomes I, IV, V, IX, and X. Diallel tests have established that gene action is largely additive but that dominance and epistasis are also involved. (I) Tifton, Ga., and (E) Missouri Agr. Exp. Sta. II-326-C

Sterile Eggs Paratized by *Trichogramma evanescens*. Eggs from tepasterilized and unsterilized fall armyworms were exposed to the parasite *T. evanescens*. Parasitism in one to five day old sterilized eggs was as high as in one to two day old unsterilized eggs. Unsterilized eggs hatch on the third day. Sterilized eggs do not hatch, making them preferable for mass rearing *Trichogramma* parasites. (I) Tifton, Ga. II-326-C

Insect Resistance in Sorghum. The oviposition rate of *Sitophilus zeamais* was significantly affected by differences in varieties of sorghum grown by natives of South Africa. (E) California State College of Los Angeles, Los Angeles, Calif. II-327-C

Improved Disease-Resistant Pearl Millet. Seedlings of pearl millet are less susceptible to seed rot, damping-off and leaf blight in the Southeast when planting is delayed until onset of warm weather. Common pearl millet, Starr, a late experimental synthetic, Gahi-1, the 4 parent inbreds of Gahi-1, and the 6 diallel crosses were inoculated at weekly intervals with *Helminthosporium setaria*. Disease reaction, which was most severe when seedlings were 1-week old, became least severe at 6 to 7 weeks. The late synthetic experimental strain remained most resistant. In addition, Gahi-1 and 2 of the diallel crosses tended to remain resistant after the 6th week. (I) Tifton, Ga. II-331-B

New Alfalfa Weevil Parasites. Over 3600 adult *Bathyplectes contracta* from Sweden and over 1000 adult "black" *Microctonus* from France were released this spring against the alfalfa weevil at sites in 12 states of the eastern U.S. The ichneumonid *B. contracta*, previously known as "bagged" *Bathyplectes*, is a parasite of weevil larvae, whereas the braconid known to date only as "black" *Microctonus* is a parasite of the adult weevil, although its eggs are originally laid in the weevil larva. A new parasite, *Velocia multispina*, was found last fall parasitizing up to 10% of the adult weevils in collections in France. Close relatives of this tachinid are known to attack beneficial beetles, including ladybugs. The host specificity of *V. multispina* is now being studied to determine whether this species may be released in the U.S. (I) Moorestown, N. J. II-331-C

Fall Armyworm Resistant Pearl Millet. Among 1,436 inbred pearl millet lines tested as seedlings, 57 (4%) were rated resistant to first instar fall armyworm feeding. Larvae fed the resistant lines made slower growth than those which were fed the susceptible lines. In addition to having antibiotic properties, force-feeding on the resistant lines made larvae more cannibalistic. Because diploid, homozygous inbred lines were used, further progress is expected in regard to the nature and genetics of insect resistance. (I) Tifton, Ga. II-331-C

Control of Nematodes in Turf with Fertilizers. In a 6-year study, an organic nitrogen fertilizer source (activated sewage sludge) reduced the number of sting nematodes on Tifgreen Bermudagrass in Georgia more than

did inorganic nitrogen (ammonium nitrate). Plant growth reflected the lower nematode infestations where organic nitrogen was used as a fertilizer source, thus explaining the long observed benefits of turf grass fertilization with organic sources of nitrogen. In other studies roots of turf grass, used for vegetative propagation, were freed of nematodes without damage to the grass by soaking cores of sod in hot water held at 50°C for 15 minutes. (I) Tifton, Ga. II-331-F

Alfalfa Plants Selected for Combined Resistance to the Spotted Alfalfa Aphid and Pea Aphid. Thirty-two alfalfa plants have been selected for high antibiosis resistance to both strain ENT-A of the spotted alfalfa aphid and the Bakersfield, Calif., and Mesa, Ariz., strains of the pea aphid. The resistant material has been turned over to the Arizona and California alfalfa breeders for future development of pea aphid-spotted alfalfa aphid resistant varieties. (I) Tucson, Ariz. II-332-C

Alfalfa Weevil Control. Two species of parasites of alfalfa weevil were liberated and a search is being made for possible clones of Buffalo variety which show anti-biosis to first instar larvae. Several have shown some promise. These biological studies of alfalfa insects are aimed at further refining control procedures. (E-fg) Arkansas Agr. Exp. Sta. II-332-C

Insect Resistant Alfalfa. Appreciable resistance to *Lygus* and alfalfa plant bugs was observed in 10 to 15% of the 123 *Medicago* accessions screened in 1967. (E-fg) Minnesota Agr. Exp. Sta. II-332-C

Cultural Control of Forage Grass Disease. In greenhouse studies nutrient solutions were used to determine the effects of various nitrogen levels upon *Helminthosporium* leaf spot severity in Kentucky bluegrass. The amount of diseased leaf tissue increased at higher nitrogen levels, but at a slower rate than total leaf tissue. The increase in disease-free tissue obtained in greenhouse tests with high nitrogen fertilization was not as great as that observed under field conditions. This difference is related to the buildup of fungus inoculum under natural field conditions versus massive greenhouse inoculations. (E-fg) W. Va. Agr. Exp. Sta. II-335-B

Kentucky Bluegrasses Vary in Tolerance to Sod Webworm. At Lexington, Kentucky, 'Kenblue' was more tolerant to sod webworm than other named varieties and common Kentucky bluegrass lots from Denmark and The Netherlands. Experimental strains with high level of tolerance to this pest are being evaluated for turf quality. (I) Lexington, Ky. II-335-C

Nutrition of Sod Webworms. *Crambus teterrellus* (Zincken) larvae were reared on an artificial diet consisting of: Bluegrass extract in water - 10 ml; wheat germ - 3.2 g; sucrose - 3 g; casein, vitamin free - 3.8 g; Wesson's salts - 1.1g; alphacel - 1 g; B-vitamin mixture - 1.1 ml; Ascorbic acid - 0.4g; Agar - 3 g; corn oil - 1 ml; distilled water - 90 ml; and methyl parahydroxybenzoate (15% in 95% ethyl alcohol) - 1.5 ml. There was

a yield of 35.8% adults from larvae reared on the diet with a duration of larvae-pupa stage of 49 days. When reared on excised bluegrass the adult yield was 62.5% and the larvae-pupa states were completed in 47 days. Without the addition of corn oil to the diet the adults emerged with malformed wings. A definition of nutritional requirements for sod webworms will contribute to knowledge of the nature of host plant resistance. (E-fg) Kentucky Agr. Exp. Sta. II-335-C

Resistance to Phytophthora Root Rot in Soybeans. Genetic studies were completed which identify the genotype of soybeans which is resistant to both races 1 and 2 of Phytophthora megasperma var. sojae. Resistance was found to be controlled by two alleles at the same locus. (I) Stoneville, Miss. II-341-B

Improved Soybeans. A new strain, R64-501, that is resistant to Phytophthora rot was developed. It resembles Lee in all plant and seed characteristics except resistance to this disease. Yields have been 3 to 4 bushels per acre higher than Lee where Phytophthora rot was severe and equal to Lee where this disease was not present. (E-fg) Arkansas Agr. Exp. Sta. II-341-B

New Soybean Variety. Custer, a variety of Scott maturity resistant to Phytophthora rot and cyst nematodes, was officially released. (E-fg) Missouri Agr. Exp. Sta. II-341-B

Oviposition and Damage to Soybeans by the Corn Earworm Proportional to Type of Pubescence. Four distinct classes of pubescence in soybeans were distinguishable with regard to the number of trichomes per square centimeter. Oviposition by the corn earworm was directly correlated with these classes, and increased with an increase in hair density. This ovipositional preference was subsequently reflected in percent damage. Damage was significantly reduced in sparsely pubescent soybean types. (I) Columbia, Mo. II-341-C

Soybean Cultivations for Weed Control. Cross cultivation continued to be superior to conventional or broadcast planting in Mississippi in fields where weeds presented a major cultural problem. This is particularly true for those weeds which are hard to control with available herbicides. Regardless of the method of planting, increased soybean stands were superior to conventional or light soybean stands for maximum yields. Soybean varieties varied widely in their ability to compete with weeds. (I) Stoneville, Miss. II-341-D

Fusarium Wilt in Safflower. Fusarium wilt was first identified as a serious disease of safflower in California in 1962. Since then it has increased to the point of prohibiting production in several fields along the Sacramento River. Safflower introductions were obtained from all over the world and screened for wilt resistance. Many of the introductions were resistant and

some were highly resistant. Those introductions with superior resistance to wilt are being released as breeding stock. (I) Davis, Calif. II-343-B

Screening Safflower Varieties for Rust Resistance. Over the past few years, hundreds of safflower introductions and selections have been repeatedly screened for rust resistance. As a result, a number of introductions have been found to be highly resistant to both the foliage phase and seedling phase of safflower rust. It is now known that there are four and possibly five separate genes for rust resistance. Incorporation of several or all of these genes into commercial varieties will give increased protection against any new pathogenic races which may appear. (I) Logan, Utah II-343-B

Controlled Atmospheres for Insect Control. A mixture averaging 48% carbon dioxide, 10% oxygen and 42% nitrogen produced 87% mortality of saw-toothed grain beetle adults exposed 1 day at 90° F. At low temperatures, high concentrations of carbon dioxide were more effective than were high concentrations of nitrogen.

A 1-day exposure at 80° F to a mixture of 40% carbon dioxide, 12% oxygen, and 48% nitrogen killed all 1-day-old adult Indian-meal moths. This mixture produced 100% mortality of lesser grain borer adults and 95% mortality of the rusty grain beetle adults in 3 days.

A 7-day exposure of adults of the confused flour beetle, red flour beetle, and a malathion-resistant strain of red flour beetle to a mixture consisting of 39% carbon dioxide, 13% oxygen, and 48% nitrogen produced mortalities of 1, 25, and 37% respectively. (I) Savannah, Ga. II-344-C

Full-Scale Controlled-Atmosphere Test. Three silos, each containing from 20,000 to 30,000 bushels of corn, wheat, or oats, were purged with carbon dioxide. A concentration of more than 35% carbon dioxide and less than 14% oxygen was attained and maintained with good distribution for periods from 24 to 95 hours after this concentration was reached. This concentration was found to be lethal to many stored-product insects in laboratory tests. Five-gallon cans of wheat treated with carbon dioxide had a concentration of more than 35% of this gas 4 weeks after application. (I) Savannah, Ga. II-344-C

Nematode Control in Grain-Peanut Rotations. In a 2-year study in Georgia, growing rye before peanuts greatly reduced injury caused by lesion nematodes (Pratylenchus brachyurus) when compared with growing oats or wheat, or use of a clean fallow, before peanuts. These data confirm that the reason rye, preceding peanuts, is a superior rotation to oats or wheat is because of the susceptibility of these grains to nematodes. (I) Tifton, Ga. II-344-F

Peanut Resistance to Northern Rootknot Nematode. Some wild species of Arachis have moderately good resistance to the northern rootknot nematode. Resistance was based on the following criteria: gall ratings, nematode development within the galls, and the number of nematodes that could be recovered from the galls. Techniques for transferring this resistance to cultivated species of Arachis are not available, but new methods are being looked for. A mild resistance to nematode development has been found in six varieties of cultivated peanuts. Crosses are being made in an effort to intensify this mild resistance. (I) Stillwater, Oklahoma. II-344-F

Peanuts Resistant to the Southern Corn Rootworm. Four lines of peanuts selected as resistant to the southern corn rootworm were retested for the fifth year. The four resistant varieties averaged 43% less damage than the susceptible variety. (E) North Carolina Agr. Exp. Sta. II-344-B

Windrow Type Reduces Microflora on Peanuts. The prevalence of microorganisms in the seed decreased during windrow, particularly when the plants were inverted to insure faster drying of the pods. Microorganisms were found in 68% of the seed at digging, in 48% following curing with the pods in contact with the soil, and in only 20% following curing on inverted plants. (I) Holland, Va. II-344-B

Control of Diseases of Peppermint and Spearmint. In cropping sequences using corn, onions, potatoes and peppermint, effectiveness of crop rotation for peppermint wilt control was dependent on when and how frequently potatoes were included. In a 5-year cropping sequence, potatoes did not increase disease incidence if grown the first year after mint and followed by 4 years corn or corn and onions. (E-fg) Indiana Agr. Exp. Sta. II-346-B

Genetics of Cotton. The genetics of blight resistance in three major American BR sources was analyzed by computer. The variety Gregg 35 and strains N.M. 9136 and N.M. 8373 were all found to contain three major genes for blight resistance. No definite linkage was found between the blight genes and 10 qualitative marker genes (sources; Texas 586 and Texas 582 marker stocks). A new major recessive gene for blight resistance was identified in a single plant selection made in the N.M. evolutionary breeding germ plasm pool in 1965. (E-fg) New Mexico Agr. Exp. Sta. II-351-B

Insect and Disease Resistance Alfalfa. Selections have been made from the new cultivar Mesa-Sirsa which have antibiosis resistance to two biotypes of the spotted alfalfa aphid, ENT-A and ENT-B, and two biotypes of the pea aphid, Mesa and Bakersfield strains. Thirty-seven alfalfa selections have been evaluated for reaction to the Egyptian alfalfa weevil. A study has been completed which evaluated a number of selections from two cultivars (African and Lahontan) for reaction to selected species of three genera of fungi causing root- and crown-rot of alfalfa in southern Arizona. Some of the PX progeny had considerably higher survival rate than the susceptible check entries when grown in soils heavily contaminated with the cotton root rot fungus. (E-fg) Arizona Agr. Exp. Sta. II-351-C

New *Bacillus thuringiensis* Preparation has Increased Activity. Preparations of the new *B. thuringiensis* culture, HD-1, were 100 times more active than commercial preparations against larvae of the pink bollworm and tobacco budworm. Results of preliminary tests indicated the same degree of improved potency against the bollworm. The high levels of activity of this microbial preparation against these major pests of cotton warrant early field trials with it for their control. (I) Brownsville, Texas. II-351-C

Chemicals Fed to Boll Weevils Reduce Egg Production. Serotonin and reserpine were fed to weevils at 50 mg per 100 g of diet. Egg production between treated and untreated weevils was compared after adults fed 0 to 5 days, and 6 to 10 days. Reduction in egg production was most marked at the 6 to 10 day interval with serotonin causing a decrease in egg production of 75% and reserpine 94% in eggs per female per day. Mortality with reserpine was 71% compared with 21% in the control. (I) Florence, S. C. II-351-C

New Pathogen of the Boll Weevil Discovered. The non-inclusion iridescent virus from the rice stem borer, *Chilo suppressalis* infected larvae and adult boll weevils by intrahaemocoelic injection and per os. (I) State College, Miss. II-351-C

Terpenoids Attract Boll Weevils. Samples of commercially available terpenoids were tested for attraction of boll weevils. Despite some inconsistencies in the responses, some of these terpenoids appeared to equal a standard extract of cotton plants in attractancy. (I) State College, Miss. II-351-C

Diapause Suppression of Boll Weevil. A study on diapause suppression was extended to include evaluation of the effectiveness of broadband infrared radiation. No significant difference was found in the effectiveness of three energy levels (0.5, 0.1, 0.05 μ w per sq. cm per mm) of violet, blue, green, yellow, and orange light. (I) State College, Miss. II-351-C

Cotton Resistance to Insects. Several lines of cotton having certain characters such as Frego bract, red leaf, glabrous leaves which have been shown previously to affect the cotton plant as a host for certain cotton insects were tested. One selection which contained a combination of the three characters previously mentioned plus a character for being glanded show a high level of non-preference to the boll weevil when compared in the same test with other lines. There was a marked contrast in the degree of infestation and in the number of punctures per fruiting structure found between this cotton selection and the other selections with which it was compared. (E-fg) Louisiana Agr. Exp.Sta. II-351-C

Effects of Virus Diseases on Cotton Insects. The nuclear polyhedrosis virus of *Heliothis zea* proved ineffective against field populations of the bollworm in cotton during the 1967 growing season. In small plot tests, the virus was inferior to methyl parathion-TDE (3/4-3 lbs./acre) and was no better than the untreated check. Integrated control tests with the virus were inferior to a straight insecticidal program. No differences in control

were detected when applications were timed with moth flights, egg counts, and larval counts. Mortality due to the Heliothis virus in cotton exhibiting a twisted bract character was significantly (40%) greater when compared to cotton with the normal square bract. Increased mortality was attributed to better deposits on the exposed squares. (E-fg) Arkansas Agr. Exp. Sta.

II-351-C

Electric Traps for Cotton Insects. Continued study of the efficiency of light traps in catching insects validated methods devised in 1966, permitting better evaluation of design factors. Trap design comparisons showed that length of attractant lamp and total ultraviolet emission exerted strong positive influences on trap catches of bollworm, cabbage looper, and tobacco budworm moths. Use of baffles and funnel diameters of 30 inches were found essential for maximizing catches.

Work with a dusk-to-dawn-type lighting fixture equipped with a 175-watt mercury vapor lamp showed that use of refractors that effectively eliminate ultraviolet radiation from the fixture emission will significantly reduce fixture attractiveness for most species of night-flying lepidopterous insects. This is significant in areas where this lighting method creates problems from nuisance insects. (I) College Station, Texas.

II-351-C

Destroying Fallen Cotton Squares. Design changes improved the effectiveness of a flail-type machine for destroying boll weevil in fallen cotton squares. It was found that the design of ground brushes, air exit opening, flail RPM and ground speed all influence machine efficiency. Boll weevil control would be maintained as long as weather conditions and plant size permitted regular machine operation. Present mounting of the equipment on a tractor precludes its use as the cotton plant approaches full growth. (I) State College, Miss.

II-351-C

A New Host of Cotton Leafworm Found. The cotton leafworm was found on Hampea in Veracruz, Mexico on several occasions. The insect probably breeds on this plant throughout the year in northern Veracruz and serves as a source of infestations on cotton in southern Texas each year. (I) Brownsville, Tex.

II-351-C

Apanteles-marginiventris Effective Against Heliothis spp. in Cage Tests. A parasite (Apanteles-marginiventris) to host ratio of 1:1.5 resulted in 95% parasitism when adult parasites were released in screen cages covering cotton plants 6 days after release of 1- to 3-day old bollworm moths. Releases of parasites 2 days after release of host moths resulted in 80% parasitism when the parasite to host ratio was 1:13. (I) Brownsville, Tex.

II-351-C

Development and Reproduction of Larvae of *Heliothis* spp. Affected by Chemicals Included in Larval Diets. Resperine, dicumarol, indole, 3-methyl indole, 3-indole acrylic acid, 3-indole butyric acid, biotin, sulfanilamide, and L-epinephrine, adversely affected larval growth and development of *Heliothis* spp. Fecundity and fertility of females were also affected when larvae were fed on diets containing melatonin, resperine, dicumarol, B-sitosterol, indole, 3-indole acetic acid, 3-methyl indole, and 3-indole acrylic acid. (I) Brownsville, Tex. II-351-C

Fertile Female Pink Bollworm Moths Sterilized by Gamma Irradiation. One to 2-day old females were allowed to mate over night and were then irradiated with 10, 15, 20, 25 and 30 kr. No egg hatch was recorded from females treated with 20 kr or more. In one test only 2 of 1745 and in another test only 3 of 3210 eggs hatched from moths treated with 15 kr. (I) Brownsville, Tex. II-351-C

Hatch of Eggs of Pink Bollworm Reduced by Substerilizing Radiation. When males treated with 12, 14, 16, and 18 kr of gamma radiation were mated with untreated females, the percentages of egg hatch ranged from 33.5 to 17 percent for the lowest and highest dosage. Hatch of eggs from F₁ adults was also reduced. However, hatch of eggs from F₂ adults increased to as much as 86 percent of the check. (I) Brownsville, Tex. II-351-C

Influence of Environmental Factors on Cercospora-Alternaria Leaf Spot Complex of Cotton. Soil-type alters leaf-spot disease incidence. Varieties grown on soil to which they are not adapted are more seriously affected than when grown on types in which they were bred. Rates of nitrogen and potassium fertilization also affect disease severity. Disease severity decreased as rates of nitrogen (0-125 lbs per acre) and potassium (0-100 lbs per acre) were increased. Comparisons of irrigated and non-irrigated cotton indicated disease severity to be greater in the non-irrigated plots. Analyses of variance showed no interaction between varieties, fertilization, and irrigation treatments. It is concluded that proper cultural practices can aid in reducing leaf-spot disease severity in the upper Mississippi delta. (E) Missouri Agr. Exp. Sta., Portageville, Mo. II-351-B

Modes of Infection for Boll-Rot Organisms. Research has shown that boll-rot organisms, even under conditions ideal for infection, seldom penetrate boll wall tissues to a significant degree. Injury, either mechanical or produced by other pests, greatly increases incidence of rot. Where no injury occurs, the most important sites for introduction of potential boll-rot organisms into green bolls are the boll tip, associated with incomplete closure; the base of the boll, at the juncture of the calyx and receptacle; and, the nectaries at the base of the boll. Varietal differences in incidence of internal rot organisms, in boll shape, and the existence of a trait for nectariless cotton, provide evidence that genetic modifications offer a means for reducing incidence of boll rot in future cotton varieties. (I) Stoneville, Miss. II-351-B

Nature of Resistance to Verticillium Wilt in Cotton Seedlings. Distribution of the wilt organism throughout the plant has been shown to be accomplished by translocation of conidia (spores) from roots to the shoot through the xylem conducting vessels. Newly formed vessels have perforated end walls which effectively prevent translocation of conidia. As seedlings age, the vessel end-walls progressively disappear to form a continuous tube of sufficient diameter to permit unrestricted movement of conidia. When this stage of growth is reached, the resistance due to the mechanical blocking of conidia progressively disappears and susceptibility to the Verticillium organism increases. (I) Beltsville, Maryland. II-351-B

Ultrasonic Energy for Bollworm Control. Field and laboratory tests revealed that bollworm moths (H. zea) detect continuous as well as intermittent ultrasound, but that behavioral responses are elicited only by intermittent ultrasound. Greatest effect on behavior was produced by 10-millisecond pulses of 20- to 30-KHz ultrasound stimuli at pulse rates of 10 to 75 pulses per second.

Acoustic sense-cell studies revealed that the output of an air whistle, a continuous sine-wave of 20 KHz frequency producing 120 dB at 10 feet, could be detected by bollworm moths at a distance of 350 feet. However, field tests indicated no measurable repellent effect or change in flight activity of bollworm moths subjected to continuous sound from this whistle. (I) Florence, S. C. II-351-C

Irradiation of Heliothis spp. for Sterility. The possibility of utilizing gamma irradiation induced sterility in Heliothis as a means of control is being studied. Four life stages of the tobacco budworm were exposed to varying dosages of gamma irradiation and the subsequent effects on egg viability, oviposition, mating frequency, longevity, and mating competitiveness were observed. Generally susceptibility decreased as development proceeded from egg to the adult moth. Irradiation of 1-3 day old pupae at dosages effecting sterility resulted in considerable mortality and adult malformation. Deleterious effects were reduced when older pupae or adults were treated. Irradiation of adults resulted in high mortality in their progeny. (E-fg) Louisiana Agr. Exp. Sta. II-351-C

Tobacco Breeding. Two new lines homozygous resistant to mosaic and highly resistant to black shank and of high yield developed in this program are being compared as to yield and quality to the two commercial varieties P R 4-65 and P.R. 5-65 (also developed in this program) in 5 regional trials in the tobacco growing area. Two hundred thirty five lines resistant to both mosaic and black shank are being selected for uniformity of type. (E-fg) Puerto Rico Agr. Exp. Sta. II-36-B

Resistance to Brown Spot in Flue-cured Tobacco. The introduction of varieties which proved to be highly susceptible to brown spot and cultural practices favorable to disease development have resulted in serious losses to this disease in recent years. Two types of resistance to brown spot

caused by Alternaria tenuis Nees., were defined in field studies. In one type, infection is limited and in the other halo formation is inhibited around infection sites. PD 121, an example of the first type, with resistance from Beinhart 1000-1, had only 13 lesions per leaf compared with 334 lesions per leaf on highly susceptible Coker 298. Breeding line NC 8038-5-9, an example of the second type, was moderately resistant to infection with 136 lesions per leaf. Lesions were restricted in size, and halo formation, characteristic of highly susceptible varieties, was inhibited on this tobacco strain. Moderate resistance is adequate to preclude the use of fungicides to control this leaf disease. (I) Oxford, N.C.

II-36-B

Electric Traps for Tobacco Insects. Experimental use of blacklight traps at a density of three per square mile for control of tobacco hornworm was continued in a 314-square-mile area near Oxford, North Carolina, and on St. Croix, Virgin Islands. Evidence of population reduction was shown at both locations. In North Carolina moth populations, Manduca sexta, inside the test area were 52 percent lower than outside for females and 56 percent lower for males, and on St. Croix the population showed a continual decrease from corresponding periods of the previous year. In North Carolina, traps were removed from the center of the area and limited numbers of sterile male moths released to compete with native males.

In studies of insect behavior the threshold of response of tobacco hornworm moths to a single 15-watt blacklight lamp was at a distance between 90 and 120 meters and for corn earworms between 60 and 90 meters. A combination of green and BL lamps proved less attractive than BL lamps alone and two types of BL phosphorus appeared equally effective. (I) Blacksburg, Virginia; Oxford, North Carolina; St. Croix, Virgin Islands.

II-36-C

Electrophysiological Responses of Tobacco Insects. Electrophysiological tests established the spectral sensitivity curve for the tobacco hornworm moth. Response of the flight-muscle nerve is probably an indication of the moth's flight deviation in response to radiant energy. Response appeared greater to ultraviolet than to visible energy. Similar examinations of signals in optic nerves were made for responses to radiant energy. Limited electroetinographic studies were conducted on tobacco budworm moths, yielding a sensitivity curve similar to that of the hornworm moth. (I) Blacksburg, Va.

II-36-C

Heritability Resistance to the Hornworm and Budworm of Tobacco. Systematic screening of a vast array of germplasm was initiated at Oxford, North Carolina, with the view of isolating and characterizing heritable forms of resistance to these tobacco pests. Over 1000 different forms of cultivated tobacco and 60 Nicotiana species are included. Early results indicate that Nicotiana gossei, a distant relative of cultivated tobacco, is resistant to the feeding damage of the hornworm. (I) Oxford, N.C.

II-36-C

Insect Resistance in Tobacco. Tobacco Introductions 1298, 1068, and 1424 were highly resistant to green peach aphids. Coker 258 and TI 1298 were heavily oviposited upon by tobacco hornworm moths. In a cooperative test in Rothamsted, England, neither susceptible nor resistant tobacco lines or varieties were colonized by the green peach aphid. The potato aphid, *Macrosiphum euphorbiae*, however colonized heavily on Ky 12 but not on other tobacco plants. The potato aphid feeds and reproduces on tobacco in the U.S. but the nymphs die and colonies do not develop. This aphid is a major vector of etch virus to tobacco, which is of increasing importance in the burley tobacco area. The possibility of its colonizing on tobacco would be of great significance in the future importance and distribution of this disease. (E-fg) Kentucky Agr. Exp. Sta.

II-36-C

Light Traps for Shade-grown Tobacco. An integrated insect-control program was tested that included insect light traps spaced at 150-foot intervals around the outside of canvas-covered tobacco fields, a systemic insecticide applied to the soil prior to transplanting, and nonpersistent insecticide treatment of the growing crop as needed. Damaged-plant data from eight other fields of tobacco that received one to two applications of insecticide weekly, considered to be a conventional program, indicated that the damage from tobacco budworms and cabbage loopers was 2.8 times greater than the plant damage in seven fields under the integrated control program. The integrated program reduced the amount of insecticide needed by a significant amount. Synthesized cabbage looper sex pheromone was incorporated with each of the 1,100 traps used in the program over the 400-square-mile shade-grown tobacco area. Cold weather reduced the insect activity after the test was started in the fall, but the results of the test were encouraging. (I) Quincy, Fla.

II-36-C

Light Traps Reducing Isolated Hornworm Population. After two years of trapping with three blacklight traps per mile over the entire island, tobacco hornworm populations were approximately 30% as high as recorded during the year prior to the trapping program. (I) St. Croix, V.I.

II-36-C

Insect Pheromone Active After Freezing. In quantitative bioassays with the cigarette beetle sex attractant, 50% of exposed males responded to 0.0003 female equivalents of the attractant. The attractant retained biological activity after nearly a year in deep-freeze storage, and has survived preliminary chromatographic purification. Improved bioassay techniques were developed. (E) University of Wisconsin, Madison, Wis.

II-36-C

Resistance to Lesion Nematodes in Nicotiana Species. Most *Nicotiana* species and tobacco varieties were severely stunted when inoculated with root lesion nematodes, *Pratylenchus brachyurus*. Some *Nicotiana* species, however, such as *eastii* and *sanderiae*, showed evidence of growth stimulation in the presence of the nematodes. A range in variability of stunting of 7 to 55 percent among tobacco varieties and 5 to 41 percent among *Nicotiana* species provided presumptive evidence of resistance. Varieties least stunted were Speight G29 (7 percent) and Coker 139 (17 percent).

II-36-C

Sugarcane Mosaic Virus Resistant Germ Plasm. Mosaic-resistant germ plasm has been developed from interspecific and intergeneric crosses involving four genera closely related to sugarcane and three species of Saccharum. Selected seedlings have been backcrossed with commercial breeding canes. There are now about 50 clones, of adequate parental type, that have not become infected with mosaic after repeated inoculations. High resistance to mosaic in commercial varieties preclude the use of insecticides to control vectors.

(I) Houma, La.

II-371-B

Sugarcane Borer Resistance Not Associated with Fiber. Distribution of fibrovascular bundles and percent fiber were determined for 18 varieties that have been classified for their reaction to sugarcane borers. Close association did not exist between distribution of vascular bundles, or percent fiber, and reaction to sugarcane borer. Thus, desirable low-fiber commercial varieties with borer resistance are feasible. (I) Canal Point, Fla. II-371-C

Leaf Spot Resistant Sugarbeet. US H20, a new monogerm hybrid sugarbeet with improved resistance to *Cercospora* leaf spot, has been released. The variety is being used in the Great Lakes region and will reduce the need for fungicides to protect the sugarbeet from leaf spot damage. (I) Beltsville, Md., and East Lansing, Mich.

II-372-B

Nematode Resistance in Sugarbeet. Progress has been made in transferring to the sugarbeet the genetic factors conditioning immunity to the cyst nematode which reside in Beta patellaris and related viny species of Beta. Currently, soil pesticides are used to reduce damage from the nematode and associated soil inhabiting pathogens of the sugarbeet. (I) Salinas, Calif. II-372-B

Virus Yellows Resistant Sugarbeet. The first American variety of sugarbeet with tolerance to virus yellows has been officially released as US H9. The variety is only moderately resistant to the virus complex, but the level of protection is sufficient to remove the major need for pesticides. (I) Salinas, Calif.

II-372-B

Burning of Crop Residues. Seed yields of Kentucky bluegrass and orchardgrass were reduced significantly when crop residue was left on the field after harvest. Where the residue was removed mechanically, sufficient vegetative material remained to interfere with the activity of herbicides. Burning the plots after harvest removed the interfering residue and made conditions favorable for control of weeds with herbicides. Burning of crop residue creates an air pollution problem. However, burning the residue in grass seed fields helps to control diseases and weeds. (I) Corvallis, Oreg.

II-38-A

Horticultural Crops

Atmosphere Modification. Continuing research to reduce the need for postharvest chemical treatments confirms that reduced oxygen concentrations (1 to 2% for tolerant commodities) or increased carbon dioxide (20 to 25% for tolerant commodities) have distinctly inhibiting effects on postharvest decay development. The application of such modified atmospheres during storage and transport can reduce or eliminate the need for chemical treatment. (I) Fresno, Calif. II-41-B

Thermotherapy. Serious losses from brown rot in California peaches, nectarines, and plums during marketing have resulted in accelerated research on control methods. Research has shown that postharvest dips with suspensions of Botran or Captan are fairly effective. However, these fungicides are more effective at much lower concentration when used in water heated to 130° F. Exposure of the fruit for 1 to 1½ minutes at this temperature results in excellent control of brown rot with minimum residues of the fungicide.

Fresh figs are highly perishable as a result of internal and external infections of fungi and yeasts. Research has shown that pasteurization in moist hot air (116° F. for 30 to 60 minutes) reduced postharvest decay and surface mold to 1/5 of that occurring in nonheated lots. The pasteurization is much more effective than any fungicide dips or fumigants used and leaves no chemical residue. (I) Fresno, Calif.

II-41-B

Biological Agents for Insect Control. The relative number of bacteria and fungi associated with spider mites, Tetranychus spp. was determined and a pathogenic entomogenous fungus, Entomophthora fresenii, was isolated. A field isolate, Bacillus sp., was found to be highly pathogenic to larvae of Heliothis zea and Pseudoplusia includens. Nuclear polyhedrosis viruses of H. zea and H. virescens were characterized by stability to heat, buffer salt and H-ion concentration, UV light and ultrasound. Trichoplusia ni has been reared aseptically through 3 generations. Pathogenicity of a hyphomycetous fungus, Spicaria rileyi, was measured in 8 species of Lepidopterous larvae and the mode of infection partially resolved. (E-fg) Alabama Agr. Exp. Sta. II-41-C

Breeding Improved Vegetable Varieties. Evaluations of 3 families of watermelon breeding lines in controlled temperature tanks to Fusarium wilt resistance was completed. Inheritance is additive in one family and seems to be controlled by 2 or more genes in the others. Field selection of F₃ and F₄ progeny of eggplant breeding lines were made with emphasis on resistance to bacterial wilt. Resistance seemed to be stabilized in most lines but fruit type was still segregating.

Greenhouse screening of cantaloupe varieties and breeding lines for Fusarium wilt resistance was initiated. Preliminary results show various levels of susceptibility of resistance in a number of commercially available lines. (E-fg) N.C. Agr. Exp. Sta. II-42-B

Electric Traps for Use With Pheromones. The comparative effects of light and of synthetic sex pheromone in attracting male cabbage looper moths were tested using screen-cage traps, conventional light traps, and electrocutor grids. Traps using only the sex pheromone as an attractant catch almost exclusively male cabbage loopers, while those including light catch female loopers and other insects as well. Quantitatively, catches of male loopers in the best screen-cage trap, using only pheromone, were similar to light traps with pheromone bait; and electrocutor grids, using pheromone and no light, caught as many as, or more insects than light traps with pheromone bait.

Comparison of two improved pheromone dispensers--a reservoir and wick vs. a polyethylene bag diffusing through its walls--showed effectiveness of the bag decreased more rapidly with time than the wick. (I) Riverside, California. II-42-C

Nematode Resistance in Vegetables. In South Carolina, plastic growth pouches are used for preliminary screening of plants grown from seed for nematode resistance. Success is dependent upon controlled temperature regimes. Small temperature differences alter resistance reactions in experimental work. Bushbeans (PI-165426) were found resistant to the root-knot nematode (Meloidogyne incognita). Germ plasm from several wild melons was found with resistance to root-knot nematode. Resistance in the wild melon species is expressed through delayed development of nematode larvae. (I) Charleston, South Carolina II-42-F

Early and Late Blight Resistance in Potato. Eight potato seedlings of over 400 tested were highly resistant to both early blight and late blight. Of the eight, two lines had less than 1 percent foliage infection from both diseases. (I) Beltsville, Md. II-421-B

Multigenic Late Blight Resistance and Multiple Disease Resistance in Potato. Over 450 potato lines were screened for resistance to Races 1, 2, 3, and 4 of the late blight pathogen. Many selections were highly resistant to late blight in the field. One selection (B6038-1) has late blight resistance combined with resistance to scab, Verticillium wilt, net necrosis, stem-end browning, and mild mosaic. (I) Orono and Presque Isle, Maine, and Morgantown, W. Va. II-421-B

Disease Resistant Potatoes. We have 5 clones that show a very high resistance to common scab; 15 show resistance to late blight; 19 that are better in chipping ability than LaChipper; 22 that show very little darkening after cooking; 48 that are very high in specific gravity; 33 that carry genes for frost resistance and one (61-68) that shows no greening after exposure to light. Two hundred and seven clones were selected this year at Rhinelander, Wisconsin, and will be screened for above characters as well as yield. (E-fg) Louisiana Agr. Exp. Sta. II-421-B

Development of Virus-Free Potato Seed. Alaska's plantings of Virus-X-free Kennebec potatoes expanded to 25 acres, with four commercial growers participating in the program; two of these grew only X-free Kennebec seed. Field tests were encouraging and the outlook for market development is optimistic. A higher yielding nearly X-free strain of Green Mountain has been developed by selecting tubers based on no or few spots produced by infected Gomphrena globosa. Data are yet inconclusive as to whether the number of spots induced in Gomphrena is due to differences in strains of virus or to differences in tubers. (E-fg) Alaska Agr. Exp. Sta. II-421-B

Multiple Disease Resistance in Potato. In Maine 58 advance selections were tested for resistance to 10 potato diseases: ring rot, scab, Verticillium wilt, leafroll, net necrosis, stem-end browning, late blight, and viruses X, A, and Y. Seedlings B6111-18 and B6138-3 were resistant to seven of the diseases. Thirty-two lines were resistant to five or more diseases. (I) Orono and Presque Isle, Maine. II-421-B

Sweet Potato Breeding. Selection N.C. 240, which has excellent varietal qualities, performed well again in 1967. Several other selections also showed promise as future fresh market and canning varieties and will be entered in the national testing program in 1968 and 1969. Field testing for nematode resistance produced several highly tolerant types which included N.C. 240. (E-fg) North Carolina Agr. Exp. Sta. II-421-B

Disease Resistant Sweet Potatoes. There were 13 advanced seedlings and varieties grown in replicated tests at several locations in 1967. Of these L4-261, a root knot resistant seedling, and L4-186, a soil rot resistant one, were outstanding in yield and most horticultural characters. L0-246, a Goldrush type, has consistently produced excellent yields of canning type roots. Other seedlings, L4-73 and L4-83, Centennial types and resistant to root knot, look good. (E-fg) Louisiana Agr. Exp. Sta. II-421-B

Potato Plant Resistance to Insects. The relative resistance to potato aphid of 284 IR-1 *Solanum* introductions was determined in field trials. We confirmed our discovery of resistance in several wild species including: *S. stoloniferum*, *hjertingii*, *hougasii*, *bulbocastanum*, *chomatophilum*, *polytrichon*, and *multidissectum*. *S. stoloniferum* accessions PI 160226, 186563, and 275246 are the most promising. Laboratory studies revealed several previously unidentified sources of potato fleabeetle resistance including: *S. brachycarpum*, *pampasense*, *polytrichon*, *sanctae-rosae*, and *stenophyllidium*. (E-fg) Minnesota Agr. Exp. St. II-421-C

Use of Defoliant on Peach Trees Makes Aphids Susceptible to Predation. In experiments to reduce the overwintering population of the green peach aphid, a vector of potato leaf curl virus, proprietary defoliant sprays were applied to the foliage of peach trees in Autumn when oviparous forms of the green peach aphid were being produced on the trees. This caused most of the leaves to drop prematurely before the egg laying aphids crawled to the twigs to deposit overwintering eggs. The surviving aphids were concentrated at the rate of more than 40 per leaf on a few remaining leaves where they fell prey to syrphid fly larvae. (I) Yakima, Wash. II-421-E

Multiple Insect and Disease Resistance in Tomato. Tomato breeding line B833 has resistance to *Verticillium* and *Fusarium* wilts, and to gray leaf spot, with field tolerance to early blight. It also has resistance to spider mites and the potato aphid. The line is a high-yielding, mid-season type with round fruit. It will soon be released to public and private tomato breeders. (I) Beltsville, Md. II-422-A

Cucumber Mosaic Virus Resistance in Wild Pepper. Two lines of wild pepper (*Capsicum frutescens*) from Columbia, South America, are resistant to the cucumber mosaic virus. These lines do not cross readily with the commercial pepper (*C. annuum*), but some F₁ seed have been obtained. (I) Beltsville, Md. II-422-B

Resistance to Curly Top Virus in Tomato. A high level of resistance to curly top has been stabilized in several breeding lines with promising horticultural potentials. When crossed with commercial varieties, these lines produce progeny with vine, fruit, and maturity characteristics promising for mechanical harvest in areas where curly top limits production. (I) Prosser, Wash. II-422-B

Breeding and Evaluation of Improved Tomato Varieties. In the tomato breeding objective, emphasis was shifted toward the development of processing varieties adapted to the Midwest and suitable for mechanical harvesting. Significant progress was made in overcoming two limitations of western varieties--late maturity and excessive fruit cracking. Genes for early maturity, nematode resistance and improved color were incorporated into several Missouri breeding lines of the processing type. Chico was rated highest of approximately 80 lines evaluated, and yields exceeding 40 T./A over simulated machine harvest were obtained. (E-fg) Mo. Agr. Exp. Sta. II-422-B

Disease-Resistant Tomatoes. Selection was continued in segregating southern bacterial wilt resistant tomato breeding lines with emphasis on improved fruit quality. Two breeding lines uniform in resistance and horticultural type were placed in the replicated variety trial. Marketable yield equaled that the Floradel and Homestead 24. (E-fg) North Carolina Agr. Exp. Sta. II-422-B

Release of Sterile Drosophila Reduces Population in Tomato Fields. In cooperation with the Campbell Soup Company at Rancocas, New Jersey, 23 weekly releases averaging 2.5 million tepa-sterilized flies were made between April 14 and September 13 in a 25 mi² area. Trapping records revealed that area releases initially suppressed Drosophila development in the tomato fields by 86%. Although it was difficult to compete with wild populations of flies, females collected from tomato fields in the release area showed an average 13% reduction in oviposition and 18% reduction in adult progeny compared to females from check areas. (I) Beltsville, Md. II-422-C

Resistance to Spider Mites in Tomato. Resistance to the red spider mite has been demonstrated for the first time to be closely associated with the number of glandular hairs on the leaves. Resistant varieties consistently have more glandular hairs than susceptible varieties. Tomato plants with a high degree of resistance to the spider mite can be identified in segregating populations by counting the glandular hairs under a microscope or by estimating the number with the naked eye when plants are about 8 weeks old. (I) Beltsville Md. II-422-C

Coffee Ground Soil Amendment Controls Fusarium Root Rot of Beans. Spent coffee grounds from the instant coffee manufacturing process added to soil at 0.5 percent caused 70 percent reduction in bean root rot caused by Fusarium solani f. sp. phaseoli. Disease control was maximal at 7 to 14 days after amending the soil. There was no reduction in pathogen propagules. Coffee-amended soil increased in fungistasis from near zero at the start, to a high level after 4 to 28 days, whereas a nonamended soil maintained a moderate level of fungistasis throughout this period. Bean root exudates did not annul fungistasis in coffee-amended soil. (I) Beltsville, Md. II-424-B

Organic Soil Amendments Evaluated for Disease Control. Incorporation of oat debris followed by seeding with snapbean resulted in highly significant increases in *Rhizoctonia hypocotyl* rot. Relative populations of common soil saprophytes did not change. In contrast, incorporation of corn stalks significantly reduced the hypocotyl decay. The soil microflora colonizing debris appears not to be related to capacity of *Rhizoctonia* to initiate hypocotyl decay of snapbeans. (E-fg)
Del. Agr. Exp. Sta. II-424-B

Cellulose Fungistasis of *Fusarium solani* f. sp. *phaseoli*. Chlamydo-spores, but not macroconidia, were sensitive to soil fungistasis. Cellulose and oat straw added to soil markedly increased the fungistatic level of the soil to chlamydo-spores. Exudates from germinating bean seed or the addition of 0.01 percent glucose did not negate the inhibitory effect of cellulose, whereas 0.01 percent glucose stimulated chlamydo-spore germination in nonamended soil. Greater amounts of glucose (0.1 and 1.0 percent) suppressed the cellulose effect. (I) Beltsville, Md.
II-424-B

Red Kidney Bean Resistant to Curly Top Virus. Royal Red is the first red kidney variety with immunity to the curly top virus. It is also the first variety with resistance to both the original and the New York 15 strains of the common bean mosaic virus. It is highly adaptable to production in the Northwest where production of red kidney beans has been severely limited by these viruses. Limited testing indicates that Royal Red is also adaptable to production in Colorado and Michigan. Where curly top was present, Royal Red greatly outyielded all commercial red kidney varieties. In the absence of curly top, Royal Red equalled or exceeded the best red kidney varieties in yield. (I) Prosser, Wash.
II-424-B

Soil Amendments Suppress *Fusarium* Root Rot of Bean. Maltose, dextran, starch, or cellulose effectively suppressed root rot of bean caused by *Fusarium solani* f. sp. *phaseoli* in soil with a pH of 5.0 or 6.8. In soil of pH 7.9 only cellulose was effective. Uramite and guanidine hydrochloride reduced disease appreciably, but the latter was phytotoxic. The effectiveness of beneficial amendments was negated or reduced by $\text{NH}_4\text{-N}$ or $\text{NO}_3\text{-N}$ supplied with carbon sources at C:N ratios of 10 and 20, but not at higher ratios. Cellulose and starch did not change inoculum density of the pathogen, whereas oat straw, glucose, maltose, and dextran increased propagule numbers. (I) Beltsville, Md. II-424-B

Selection for Fusarium Root Rot Resistance in Beans. Seven hundred lines of beans previously evaluated for horticultural characteristics were tested for root rot susceptibility in the field and greenhouse. The association between the root rot scores and horticultural characteristics such as habit and color will be calculated. A second population of 1500 bean lines was grown and described in preparation for subsequent root rot susceptibility tests. Correlations obtained in this study should be useful in root rot resistance work and should contribute to the understanding of the nature of root rot resistance. (E-fg) Oreg. Agr. Exp. Sta.

II-424-B

Breeding Disease Resistant Peas. Greenhouse and field tests were used to evaluate pea breeding material for resistance to enation mosaic virus, the pea streak virus complex, powdery mildew, wilt, near wilt, and root rot. The selection program was continued and advanced materials increased for larger trials. Previously increased lines were evaluated in drill trials on the research farm and by cooperators in many areas. Several of these lines may be selected for further increase and possible release. (E-fg) Oregon Agr. Exp. Sta.

II-425-B

Fertilization and Organic Soil Amendment Affect Pea Root-Rot Severity. Aphanomyces euteiches can utilize the organic and NH_4 -Nitrogen but not the nitrate-nitrogen form. NO_3 -N reduces the severity of root rot while NH_4 -N increases the amount of root rot. NH_4 -N will cause the occurrence of root rot at relatively low levels of the pathogen and the severity of root rot increases rapidly with increasing levels of inoculum. Reductions in the severity of Aphanomyces root rot of peas when NO_3 -N is applied is believed to be due to the reduced growth of the pathogen under the influence of NO_3 -N and an increase in the number of competing organisms. There is a significant increase in the number of antagonistic organisms when NO_3 -N is applied to loamy soils but the effect is less pronounced in sandy soils. Studies have indicated that Clinton oats and Clinton derivatives such as 6643 and 7114 are susceptible to A. euteiches. Planting of a susceptible oat variety prior to peas may cause a significant increase in the inoculum potential of A. euteiches and account for severe root rot outbreaks in areas where peas have not been planted for several years. (E-fg) Minn. Agr. Exp. Sta.

II-425-B

Sweetpotato Virus-Vector Relation and Virus Control. Under greenhouse conditions the green peach aphid, and not the Abutilon whitefly, was implicated in the natural transmission of the russet crack virus in sweetpotato. Positive control of russet crack virus by heat treatment was achieved by growing plants at high temperatures (over 100°F .) for several months and rooting the virus-free, apical growth. (I) Beltsville, Md.

II-426-A

Insect-resistant Sweet Potatoes. Selection from a random breeding population yielded sweet potato clones with outstanding resistance to injury by soil insects. Several surpass the previous standard (La 3-64) in resistance to the *Diabrotica*-wireworm-*Systema* complex and in addition possess resistance to white grubs which La 3-64 lacks. (I) Charleston, S.C. II-426-C

Downy Mildew Resistant Lettuce Varieties. Two head lettuce varieties, Valtemp (M-5) and Valrio (M-16), were released which have better resistance to downy mildew, temperature extremes, and premature bolting, than present commercial varieties. Valtemp has greater adaptability as an early season variety under warmer conditions, whereas Valrio is better adapted to colder temperatures and midseason harvest. Both produce higher quality heads than present varieties when planted at the proper time. (I) College Station, Tex., and La Jolla, Cal. II-427-B

Downy Mildew Resistance In Spinach. Norgreen, a mildew-resistant, longstanding, flat leaf variety was released to seedsmen this year. It is adapted to spring production in the mid-South and eastern seaboard, and summer production in the Pacific Northwest. Norgreen is comparable in quality to the mildew-susceptible Northland. Norgreen outyields Northland by 1 to 3 tons per acre even where mildew is not a problem. (I) Beltsville, Md. II-427-B

Bacillus thuringiensis Controls Cabbage Looper in Pilot Field Test. In spring and fall season tests on cabbage, *Bacillus thuringiensis* dusts and sprays provided plant protection equal to that provided by the most effective of currently recommended insecticides. (I) Charleston, S.C. II-427-C

Cabbage Looper Populations Reduced by Light Traps and Sex Attractant. A battery of 415 blacklight traps baited with the synthetic sex pheromone of the cabbage looper was put in operation on a 2240-acre lettuce ranch. The traps have removed many millions of moths with the result that populations of the cabbage looper, corn earworm, beet armyworm, and salt marsh caterpillar are much lower than in a similar lettuce producing ranch 12 miles away. (I) Mesa, Ariz. II-427-C

Nonchemical Control of Cabbage Looper. Operation of a large-scale installation of blacklight insect traps baited with synthetic cabbage looper sex pheromone was continued on a lettuce-producing ranch near Red Rock, Arizona. There are 415 trap locations on 2,240 tillable acres. Data on insect collections and crop damage are compared with an unlighted check area 8 miles away near Picacho, Arizona.

During this first season equipment functioned satisfactorily and unexpectedly large numbers of insects were caught. Ratios of male catches to female catches for the cabbage looper were high in both locations, indicating influence of the pheromone, but ratios of males to females were higher at Picacho than at Red Rock during population peaks. The grower applied usual amounts of insecticides in both areas and insect populations remained low. Additional data must be accumulated for adequate evaluation. (I) Tucson, Arizona.

II-427-C

Biological Control of Imported Cabbageworm. Preliminary field tests indicate that economic nonchemical control of the imported cabbageworm, Pieris rapae, may be possible by means of mass releases of both parasites and the pest itself. The mass release of the pest insect provides additional host material allowing for a more rapid buildup of the parasite populations. In an acre plot of Pieris-infested cabbage, 27,000 fertile butterflies, 1,070,000 of the egg parasites (Trichogramma evanescens), and 6500 larval parasites (Apanteles rubecula), were released over a period of one complete generation for each species. Total mortality of the first brood Pieris in the field, based on detailed egg and larval counts per 100 plants, was 99.2%. Additional study is underway of induced high host and parasite populations in synchronized generations to reduce P. rapae infestations to an economically acceptable level. (I) Columbia, Mo.

II-427-C

Parasitism and Viruses Reduce Looper Population Throughout Year. Collections from various cultivated hosts showed that the Tachinid fly, Voria ruralis, parasitized 42% of the larvae of the cabbage looper during January-March, 30% during April-May, 5% July-September, and less than 1% from October to December. In the same collections the polyhedral virus destroyed 34% of the larvae during January-March, 22% in April-May, 46% July-September, and 84% in the period October-December when parasitism by Voria was lowest. (I) Mesa, Ariz.

II-427-C

Newly Discovered Virus Reduces Cabbage Looper Populations in Pilot Test. Field cage studies showed that the recently discovered cytoplasmic polyhedrosis virus of the cabbage looper can infect and reduce a population under semi-natural conditions. An 83% reduction in total pupae was obtained and mean pupal weights were lowered by 12 and 32 mg for males and females respectively. (I) Riverside, Calif.

II-427-C

Imported Cabbageworm Parasite. The European braconid Apanteles rubecula has been successfully established in Missouri. Stock of this parasite of Pieris rapae had been obtained from British Columbia, where the species had been accidentally introduced, and was released in Missouri last year. The species successfully overwintered and parasitism of P. rapae by the species ranged from 10-50% at the release sites this spring. Emergence of A. rubecula was more closely synchronized with emergence of Pieris than was the emergence of the previously established Pieris parasite, Apanteles glomeratus, and in addition field parasitism by the newly established species was significantly greater than that of A. glomeratus. Experiments on the mass release of A. rubecula are now being conducted. (I) Columbia, Mo. II-427-C

Breeding for Disease Resistance in Cucumber. Interspecific cross of Cucumis species was accomplished for the incorporation of general and nematode resistance into C. melo. A new breeding method combining mass selection and convergent improvement has made real progress in retaining more desirable characteristics than by the pure line method. (E-fg) Ala. Agr. Exp. Sta. II-428-B

Breeding and Improvement of Melon Varieties. F_1 hybrid cantaloupes can double yields and improve quality even without resistance to major diseases. Research was completed on production and use of hybrid seed. It is now possible to produce F_1 seed commercially without hand labor and use it efficiently in large field plantings. Present emphasis is on perfecting other parental strains carrying available resistance to crown blight, mildew, and viruses. Methods and germ-plasm are now being extended to Honey Dews. Breeding is in progress on new varieties for mechanical harvest, for freeze-processing and for other new uses. Greenhouse and laboratory research has produced information on effects of viruses, on virus resistance, on vegetative propagation, on genetic linkage and related studies on muskmelon physiology. (E-fg) Ariz. Agr. Exp. Sta. II-428-B

Electric Traps for Cucumber Beetles. Use of light traps alone and of light traps plus insecticide has been compared for 2 years for protection of short-season hybrid cucumbers grown for pickling. Results show no real differences in insect damage, beetle population, yield, or incidence of bacterial wilt within 700 feet of light traps. Interpretation could be that light traps are as effective as insecticides; however, combined effects of cultural practices, varieties grown and environmental factors really eliminate need for beetle control except under optimum conditions for insect multiplication. Lafayette, Indiana. II-428-C

Insect Resistance Measurement in Cucurbits. Cucurbitacin, an alkaloid commonly found in cucurbits, was found to be in high concentration in cucurbits that are highly resistant to the cucumber beetle. A spectrophotometric technique was developed which will permit the measurement of cucurbitacin in single cotyledons of melon seedling populations. (I) Charleston, S.C.

II-428-C

Traps Baited with Virgin Female Lesser Peach Tree Borer Moths Highly Attractive to Males. Marked laboratory-reared males were released in the center of the 45-acre experimental peach orchard to determine the efficiency of 60 sticky traps, each baited with 6 virgin females. A total of 3,206 marked males were made between May 27 and July 28 1967. Recaptures ranged from 69 to 92%, with an average of 82%. A total of 4,987 marked males were released different distances from the Patoka peach orchard during the period June 7-September 15. Recoveries for each release point were: 1/4 mi.--47% 1/2 mi.--43%, 3/4 mi.--22%, 1 mi.--22%, 1-1/2 mi.--17%, 2 mi.--15%, 3 mi.--4% and 4 mi.--6%. One marked male was captured in each of 2 traps 9 and 10 miles from the release point. (I) Vincennes, Ind.

II-431-C

Heat Treatment Frees Alfalfa Clones of Alfalfa Mosaic Virus. Alfalfa plants infected with several alfalfa mosaic virus isolates were subjected to a continuous temperature of 35-36 C. Cuttings from treated plants were periodically assayed for virus infection. No recurrence of virus has been detected in cuttings ranging in age from 10 to 18 months from heat treated plants. (I) St. Paul, Minnesota.

II-432-B

New Pea Aphid Resistant Alfalfas Prove Their Worth. In much of Kansas and part of Nebraska, pea aphids destroyed most of the first crop of susceptible alfalfa varieties in the absence of insecticides. Dawson, a resistant variety released in 1967 from the cooperative program with Nebraska Station withstood damage from the pea aphid. KS-12, an experimental Kansas synthetic had no symptoms of damage. KS-12 also has high resistance to the spotted alfalfa aphid and bacterial wilt, and in addition is an improvement over Cody and Buffalo in leafspot resistance. (I) Manhattan, Kansas.

II-432-C

Coccinellids Efficient Predators of Apple Aphid. Large early-season populations of apple aphids were controlled by lady beetles in a 1-acre planting of dwarf apples planted for biological control studies. The beetles appeared in large numbers during early May and persisted through the summer. Nearly every tree became infested with Aphis pomi late in April, but the beetle predators increased rapidly and eliminated the aphid population. The adults fed more actively than the larvae on terminal leaves where aphids were most abundant. The larvae also fed on mites. (I) Kearneysville, W. Va.

II-433-C

Codling Moth Sex Pheromones Synthesized. A sex pheromone produced by virgin female codling moths has been isolated in pure form. Extraction of 20,000 moths yielded only 7 micrograms. This is less pheromone per insect than has previously been reported for any other insect species. Studies of the chemical structure of the pheromone indicated that it contains an epoxide group. An exploratory survey of epoxides as possible substitute sex pheromones was initiated. Of 21 epoxides synthesized and bioassayed in the laboratory, 20 evoked the typical sexual response of the males. The most potent one was cis-9,10-epoxyoctadecan-1-01, which caused a response at a concentration of 1 part per billion in test solutions. (I) Yakima, Wash. II-433-C

Equipment for Mass Rearing of Insects. Work was continued on development and improvement of equipment associated with mass rearing of codling moths for sterile male release programs. Equipment included a machine for separating pupae of sex through size difference, an apparatus for separating mature pupae from other pupae by differences in reflectivity in the infrared region of the spectrum, and a flight mill for evaluating the vigor of moths hatched from pupae exposed to gamma radiation for sterilization. (I) Yakima, Washington. II-433-C

Equipment for Aerial Release of Sterile Male Insects. Equipment was developed and tested for metering and dispensing sterile male codling moths from a helicopter. Powered by a variable-speed electric motor, this device also partially opens the cardboard containers as it dispenses them. Turbulence of the air under the helicopter completes the opening of the box, allowing the insects to spill out after initial deceleration of the container. (I) Forest Grove, Oregon. II-433-C

Biological Control of Pear Psylla. Studies on the pear psylla, Psylla pyrocola, revealed this pest to have been adequately controlled through the activity of predators and parasites. Mortality of the pear psylla was measured during the winter months through pear harvest in October. It is believed that biological control has the potential to replace chemical methods of control for this pest. (E-fg) Oregon, Arg. Exp. Sta. II-435-C

California Red Scale Males Fly 380 Ft. Males were marked with Calco-oil dye and released in a mature orange grove. Tanglefoot cards on ice cream cartons baited with virgin females were placed in concentric circles at various distances from the release point. Marked males were trapped 300 ft. upwind and 380 ft. downwind from the release point. The greatest number was recovered downwind. (I) Riverside, Calif. II-44-C

Microterys flavus the Predominant Parasite of Brown Soft Scale in Rio Grande Valley Citrus Grove. After making up approximately 5 percent of the parasite species in observations since 1962, this parasite rose to 55 percent, 54 percent, and 74 percent of the total collected during successive months in 1968 year. In some groves 65 percent of the scales collected were found to be parasitized, the highest levels of parasitism recorded since observations were started in 1962. More frequent rainfall and higher humidities during the past year are believed to be responsible for this change in relative abundance of parasite species. (I) Weslaco, Tex. II-44-C

Electric Traps for Pecan Insects. A light-trap experiment was begun in an isolated 8 acre pecan grove using 33 traps with single 15-watt BL lamps. Hickory shuckworms were the only important pecan insects captured. Monitor traps outside the orchard on all four sides caught only 59 shuckworm moths, indicating no migration. Shuckworm infestation in shucks averaged only 14.6 percent in the lighted grove with a nut crop average over 50 lbs./tree. Flight activity of female shuckworm moths was found to be greatest about 1 hour after sunset, with male flight increasing rapidly at the same time but continuing at a high level 2-3 hours longer. (I) Albany, Georgia. II-471-C

Forests

Choice of Material Important in Urban Plantings. There is a pressing need for genetically better street and park trees: trees that are acceptable from the standpoint of growth-rate and growth-habit; trees adaptable to a wide range of environmental conditions; and trees resistant to disease, insects, and air pollutants. A paper presented at the annual meeting of the New Jersey Federation of Shade Tree Commissions, was based on more than forty years of tree improvement research, and observations of many tree species suitable for amenity planting. It provides the guidelines for selecting and immediately utilizing superior individuals, and for producing better amenity trees through selective breeding and hybridization. These guidelines are needed by shade tree associations and individuals in the field and can be put into immediate use. Proper choice of trees will reduce disease and insect problems and also the need for use of pesticides. (I) Durham, New Hampshire. II-5-A

Avoidance of Annosus Root Rot a Possibility. A numerical rating by which Polish planting sites can be classified according to infection hazard from *Fomes annosus* has been developed. The rating is based on the ratio of beneficial soil organisms to total soil microflora. Healthy stands have ratios of 5000+ while badly infested stands are lower than 1000. High hazard sites are defined as those with ratios lower than 2000 and conifer plantings should be avoided on these. (E) Poland, PL-480. II-5-B

Biological Control of Dwarf Mistletoes. Investigations of possible biological control agents for dwarf mistletoes continue in the West. *Cytospora abietis*, a fungus parasite that occasionally causes a canker of red fir and white fir is commonly associated with dwarf mistletoe infected branches. The fungus was found on 30 to 40 percent of the dwarf mistletoe infections and appears to suppress growth and exert considerable control of dwarf mistletoe in some areas. (I) Berkeley, California. II-5-B

Evaluation of a Biological Control Agent for Blister Rust. Evaluation of the fungus *Tuberculina maxima* as a possible biologic control agent for blister rust continues. It is known that the fungus can overwinter as spores, sporodochia, or endogenous mycelium on blister rust cankers. Field and laboratory inoculations of blister rust cankers on western white pine during periods of aecial production, pycnial production, and no sporulation show that cankers are susceptible to infection by *T. maxima* only during periods of aecial and/or pycnial production. This limited infectivity definitely hinders the potential of this organism as a biologic control agent. (I) Moscow, Idaho. II-5-B

Efforts in Non-Chemical Control of Dutch Elm Disease. Naturally-occurring bacteria and fungi flushed from healthy elms by centrifugation were tested for potential antagonism to Ceratocystis ulmi in plate culture. Three bacterial isolates inhibited the fungus, but cell-free filtrates did not. The data suggest possibility of antagonism in vivo that might prevent initial infection. Observation of development of Dutch elm disease under both chronic and acute gamma radiation and fungus spore survival following acute radiation was continued. Inoculated-irradiated trees were less subject to disease than inoculated but nonirradiated controls, but not significantly. (E-fg) Me. Agr. Exp. Sta. II-5-B

Forest Tree Seedlings and Soil Fungi Relationships. Root diseases are not a problem in a certain State Tree Nursery in Maryland where no fungicides are used. In a nearby nursery, however, soil fungicides are used regularly and soil pathogens are a recurring problem. Many more saprophytic fungi were found in soil samples from the former than from the latter nursery. Two of the most common saprophytic fungi, a Penicillium sp. and Aspergillus niger, were isolated into pure culture. Roots of aseptically grown Virginia pine seedlings 10-12 days old were completely rotted within 120-140 hr when placed on agar cultures of the root rot fungi, Pythium debaryanum, Phytophthora cinnamoni or Rhizoctonia solani. If the roots were first placed on cultures of either of the two saprophytic fungi before being placed on plates containing the pathogens, rotting was delayed by an average of 40 hr. (E-fg) Md. Agr. Exp. Sta. II-5-B

Brown-spot Resistance in Longleaf Pine. Brown-spot needle blight defoliates longleaf pine seedlings, delays initiation of height growth, and is a serious obstacle to regeneration of longleaf pine in the Southern United States. Control of the disease is usually by use of controlled burning. Fungicides are effective, but expensive. Results from a geographic source study of longleaf pine in South Mississippi show that infection can be reduced by proper choice of seed source. Some individuals appeared highly resistant for the several years of planation observation. These trees will be used in the program to breed brown-spot resistant trees. The improved lines will reduce the need for use of fungicides and for controlled burning with its consequent air pollution. (I) Gulfport Mississippi. II-5-B

Gains High in Cottonwood Resistance to Melampsora Rust. The use of superior clones of cottonwood in plantations would result in increased quantity and quality of timber production over unselected material currently in use. Results from a test of 49 random cottonwood selections demonstrated that expected gains from selecting the best 10 percent of the clones would be: resistance to melampsora rust 73

percent; first year height 9 percent; diameter 11 percent; and number of branches 19 percent. More extensive collections of clones are being tested. Those with superior attributes will be identified and, through asexual reproduction which retains the full genetic potential of the material, used to establish commercial plantations. (I) Stoneville, Mississippi. II-5-B

Careful Crop Tree Selection Reduces Rust Damage. Comandra rust, caused by Cronartium comandrae, is common and moderately damaging on ponderosa pine in the Pacific Northwest. The disease is often overlooked or confused with other causes of damage. Cankers in lower crown are immediate threats to young-mature trees, but rust-killed tops in old-growth timber are not necessarily indicative of high-risk trees. The rust is of slight importance in unthinned stands and damage in thinned stands can be reduced by careful selection of crop trees. (I) Corvallis, Oregon. II-5-B

Fusiform Rust Damage Related to Loblolly Pine Seed Source. Recent results of several long-term studies of loblolly pine indicate that substantial losses could be incurred by the use of seed from the wrong geographic source, particularly if seed is moved from north to south. Conversely, worthwhile gains may be obtained from the use of seed moved short distances south to north. Results after 10 years of an intensive study of seed source differences in Georgia show that seed may be moved inland or northward and exceed the local source in growth though perhaps being more susceptible to fusiform rust and surviving less well initially. Coastal Plain sources exceeded Piedmont sources in growth in the Piedmont but not in the mountains. There, Piedmont sources were best. (I) Macon, Georgia. II-5-B

Hybrid Poplars Resist Diseases in Plains Test. Some meadow sites in sandhills areas of Nebraska and other Plains States are either too wet or too alkaline for best growth of conifers. Yet, livestock protection windbreaks are needed in these areas. Some hybrid poplars appear reasonably well adapted for these wet-meadow sites. Of 21 different poplar hybrids tested for 10 years at several locations in Nebraska, hybrids of Populus deltoides x P. nigra cv. Caudina were the best. They grew 30 to 40 feet tall in 10 years, were straighter and more narrow-crowned than common native cottonwood, and have appeared relatively free of disease cankers to date. These promising results indicate that some of these clones are immediately useful in the Plains and suggest the creation of new hybrids between selected parents from these two species. (I) Lincoln, Nebraska. II-5-B

Improved Guidelines for Silvicultural Control of Dwarf Mistletoe.

Several factors significantly influenced infection probability of dwarf mistletoe in a western study. The probability of tree seedlings less than 42 inches tall being hit by seed of the parasite from overstory trees is less than 2 in 1000. Less than 1 percent of these establish infections and seed removal by snow action is the most important factor influencing this percentage. With this knowledge, guidelines for dwarf mistletoe control can be modified to allow forest managers in the northern Rockies 5 to 10 years to obtain natural regeneration beneath infested overstories (prior to their removal) without appreciable infection of the regeneration. (I) Moscow, Idaho. II-5-B

Pond Pine a Possibility for High Fusiform Rust Hazard Sites. Pond pine, previously considered highly susceptible to fusiform rust in the South, was shown to be resistant to infection. It can rival the more commonly planted, but highly susceptible, slash and loblolly pines for growth and form on better drained sites. This offers the possibility of using pond pine in situations where loblolly and slash cannot be grown because of the high rust hazard. (I) Asheville, N. C. II-5-B

Timely Salvage Reduces Decay Loss. A long-term study of decay and discoloration associated with skidding injuries in Lake States yellow birch and sugar maple shows that value losses are very low 10 years after injury. Certain wound characteristics are closely correlated with value loss and can be used to identify trees sustaining nearly all loss. Since nearly all northern hardwood stands in this region are managed under a selection system with a 10-year cutting cycle, high-risk trees injured during the preceding cut could be removed during each successive cut and losses sharply reduced. (I) Marquette, Mich. II-5-B

Bark Beetle Responds to Synthetic Sex Attractant. The first flight response of a bark beetle to a synthetic replicate of its natural sex attractant under field conditions was reported by a team of scientists from the Forest Service, University of California, and Stanford Research Institute. The synthetic material was a mixture of three terpene alcohols isolated originally from frass of the insect, the California five-spined engraver. Two insect predators of this bark beetle also responded strongly to the attractant. Synthetic production of this and other bark beetle attractants will facilitate large-scale use of them in surveys and, perhaps, for mass trapping as a control measure. (I) Berkeley, California and (E) University of California and Stanford Research Institute. II-5-C

Predators of the Douglas-Fir Beetle. Minimal food requirements for the first and second instars of the predator Medetera aldrichi have been determined. The number of hosts required is related to host size, but as few as two, second instar Douglas-fir beetle larvae are sufficient for development of the predator to the third instar. Prepupal larvae and pupae of Medetera aldrichi were found to be light positive. (E-fg) Nebraska Agr. Exp. Sta. II-5-C

Site Burning Controls Cone Insect. Valuable seed crops in seed orchards and seed production areas can be destroyed by insects such as the red pine cone beetle, now one of the most serious pests affecting red pine seed production in the Lake States. Study of its life cycle and field trials have shown that controlled burning of the litter when the insect is hibernating in cones on the ground will substantially reduce populations and subsequent loss of cones. (I) St. Paul, Minnesota. II-5-C

Removal of Larval Shelters Favors Predation of the Gypsy Moth. Careful removal of dead branches, branch stubs, bark flaps, and other shade and shelter placed on the trees where the larger gypsy moth larvae remain during daylight hours will result in a much larger proportion of them going down into the litter where they are subject to intensive predation by deer mice and other small mammals. Observation and analysis of data from study plots in New York and Connecticut have indicated a strong relationship between the relative numbers of resting sites on host trees and survival of the insect. (I) Hamden, Connecticut. II-5-C

Low-Volume Applications of Virus Spray May Be Effective. Field and laboratory tests in Oregon have shown that aerial applications of the Douglas-fir tussock moth nuclear polyhedrosis virus can be reduced to 0.2 gallons per acre without decreasing insect mortality. (I) Corvallis, Oregon. II-5-C

Mass Rearing of Sawfly Produces Large Quantity of Virus Polyhedra. The European pine sawfly, Neodiprion sertifer is highly susceptible to a nuclear polyhedrosis virus. Provisional field dosages have been developed for practical control. This year over 750,000 larvae were infected with the virus and maintained until death. The diseased larvae were processed and decontaminated to yield nearly 2 pounds of clean polyhedra for more definitive laboratory and field testing. (I) Hamden, Connecticut. II-5-C

Nematode Parasites. Nematodes of the genus Contortylenchus were consistently more effective than those of the genus Parasitylenchus in reducing egg production of Ips sulcifrons in laboratory tests. Many larvae and pupae of the beetle also were killed by Contortylenchus. (I) Albuquerque, New Mexico. II-5-C

Arthropod Enemies of Pine Insects. A survey was conducted to ascertain the major natural enemies of the bark beetles, Ips spp. Dendroctonus spp., and the bark weevils, Pachylobius picivorus and Hyloivius pales. Early results revealed at least two species of mites associated with adults of Ips avulsus and P. picivorus. Eighty-eight and 63 percent respectively, of I. avulsus and P. picivorus adults examined contained mites. Thirty-eight percent of the I. avulsus adults were infested with an apparently parasitic nematode. An ostomid predator, Temnochila virescens, was common under the bark of trees infested with I. spp. (E-fg) Alabama Agr. Exp. Sta. II-5-C

Scotch Pine Provenance Resistant to Sawfly Attack. A series of Scotch pine provenance test plantings in the Lake States became infested with the European pine sawfly, providing an opportunity to evaluate genetic differences in resistance among 21 varieties from 108 Eurasian seed-lots. Trees of the variety uralensis were significantly less attacked, while those of variety iberica were severely attacked. In all others, severity of attacks varied with tree height with no pattern of genetic differences apparent. (I) East Lansing, Michigan. II-5-C

Combination Virus-Bt Spray Controls Tent Caterpillar. Application of a nuclear polyhedrosis virus and Bacillus thuringiensis by helicopter resulted in a high rate of infection of colonies of the Great Basin tent caterpillar. Incidence of the virus in the colonies increased with amount of spray deposited and number of days after spraying. Populations were 95 percent lower in the treated area than in the untreated area the year following the test. (I) Albuquerque, New Mexico. II-5-C

Selective Thinning of Host Trees May Regulate Jack-Pine Budworm Populations. After hatching in late summer and following emergence from hibernation in the spring, many small larvae fall to the ground or are carried off by the wind. Losses in the spring are greatest, sometimes ten times those in the summer dispersal period, and highest larval mortality occurs in the more open stands (30 square feet of basal area per acre or less). Selective thinning to reduce the stocking of host trees thus may maintain population densities of the insect at low levels. (I) St. Paul, Minnesota. II-5-C

Planned Diets for Rabbit Control. Because of the shortcomings of chemical repellents to hares and rabbits better control measures are needed. Development of new methods requires knowledge about the habitat requirements of the animal, its preference for different foods, and factors affecting feeding habits. This line of research was started with a study of hares' reaction to a diet of catsear plant, a preferred food, on a tract cleared of Douglas-fir in Washington. The study showed that the animals preferred flowers and flower buds over the leaves of the plant. The study also showed that the level of sugar in the different parts of the plant might be responsible for the observed order of preference. Plants rich in sugars, therefore, might be used to divert these animals from less-sweet planted seedlings. (I) Olympia, Washington. II-5-G

TARGET III

TO DEVELOP SAFER AND MORE EFFECTIVE PESTICIDE USE PATTERNS, FORMULATIONS, AND METHODS OF APPLICATION; AND IMPROVED METHODS FOR DETECTING, MEASURING AND ELIMINATING OR MINIMIZING PESTICIDE RESIDUES IN PLANTS, ANIMALS AND THEIR PRODUCTS, AND IN OTHER PARTS OF THE ENVIRONMENT

General

Behavior of Herbicides in Soil. In Mississippi, bioassays and chemical analyses of soil from greenhouse and field plots strongly indicated that the persistence of trifluralin increases with the depth of incorporation in the soil. Residues from trifluralin probably will not accumulate with repeated annual applications at normal rates of use, however, persistence from the end of one season to the beginning of the next may be sufficient to injure crops following in rotations. This is particularly true for trifluralin sensitive crops such as sugarbeets. (I) Stoneville, Mississippi. III-1-A

Distribution of Solid Materials From Aircraft. Trajectories of granular particles released from an aircraft show that wingtip vortices exert a significant influence only on the path of small particles less than 500 micron diameter, provided that the particles are released at a point on the wing outside the core region of the tip vortex. A computer program was modified to compare experimental trajectory and theoretical wingtip vortex data to develop empirical relationships. A theoretical analysis of the mechanics of solid particles dispersed from aircraft by pneumatic spreaders yielded equations which are being verified by simulated tests. Valid equations will facilitate improved design of application equipment. (E) Mississippi Agr. Exp. Sta. III-1-A

Transport and Dispersion of Fine Spray Particles. A wind tunnel was completed to provide a means for producing controlled turbulence. Measurements of turbulence were made in the tunnel to indicate the zone where nonvarying turbulence exists. Data analysis procedures have been developed to describe states of turbulence. Limited measurements were made of the turbulence in the boundary layers of thin plates with various shaped leading edges suspended in the air stream. Field measurements were made of turbulence within and

outside of plant canopies. Partially completed data analyses include average air velocity variations, histograms of velocity variations, and auto and cross correlations to describe the natural states of turbulence. (I) Wooster, Ohio.

III-1-A

Electrostatic Spraying From Aircraft. An electrostatic boom was developed for use on a single engine fixed wing airplane. This boom had 1,065 capillary tube openings .0135 inches in diameter and a copper charge bar mounted 1.5 inches from the tubes. Static charges up to 25 KV were tested at pressures up to 40 psi, with no measurable change in discharge rate from the tubes. (I) Beltsville, Maryland.

III-1-A

Quantitative Measurement of Pesticide Drift. Spray droplets of dye in water were generated with a spinning disk atomizer, in a low-speed wind tunnel designed for straight, nonturbulent airflow at velocities from one to ten miles per hour. The spinning disk will produce droplet sizes as small as 100 microns in diameter. A different generator will be required for smaller sizes. Fixed photographic film sheets were used to collect smooth-edged impressions of the droplets. Methods for accurately measuring the droplet impressions are being studied. (I) College Station, Texas.

III-1-A

Herbicide Residues in Irrigation Water. Scientists in Denver, Colorado, developed more accurate and efficient methods of determining residues of dalapon and xylene. The minimum detection levels were 0.1 and 10 ng. respectively. (I) Denver, Colorado.

III-1-A

New Methodology for Pesticide Analyses. Basic parameters of the microwave powered plasma emission detector have been determined. Through changes in instrumental design we have greatly improved the signal/noise ratio. A method has been developed for the semi-quantitative determination of alcohols, phenols, amines and anilines (common pesticide metabolites). These compounds can be converted to their diethylphosphate derivatives and determined by an alkali-flame detector after gas-chromatographic separation. The modified detector makes use of a pressed, high purity rubidium chloride or potassium chloride pellet with a 1 mm bore, which is placed on the jet tip of a regular hydrogen flame detector. Minimum detectable limits are between one and ten picograms of original compound injected and the calibration curves are linear for a concentration range of five orders of magnitude. (E-fg) Missouri Agr. Exp. Sta.

III-1-A

Reduction of Herbicide Concentrations in Irrigation Water. In two canal treatments initial concentrations of 419 and 489 ppm of xylene in water were rapidly reduced as the treated water moved down the canal to concentrations of 3.5 and 13.0 ppm, respectively, at 8 and 9 miles below the points of introduction. The maximum concentration of dalapon in irrigation water below a section of canal treated at 20 lb/A for control of bank weeds was 365 ppb. The concentration was reduced to 18 ppb in 30 minutes and to 0.1 ppb in 24 hours. A treatment of amitrole at 6 lb/A on banks of another canal resulted in a maximum concentration of 24 ppb in water immediately below the treated

section of the canal and of only 8 ppb 30 minutes later. The maximum concentration 1 mile downstream was only 11 ppb. (I) Denver, Colorado.

III-1-A

Fumigation of Hives Control Bee Diseases. Colonies of honey bees established on ethylene oxide fumigated hive equipment from American foulbrood diseased colonies have remained free of this disease for seventeen months. Colonies of honey bees established on ethylene oxide fumigated equipment from Nosema diseased colonies outproduced control colonies by 8 to 1. (I) Beltsville, Maryland.

III-1-B

Synergist for Carbaryl. Hoffman and LaRoche RQ-5-8019 was evaluated as a synergist for carbaryl against susceptible almond moth larvae to establish a base for comparison with resistant strains. Only about one-third as much carbaryl was required for the LD₅₀ when the synergist was used at a ratio of 5 (synergist) to 1 (carbaryl). The amount of carbaryl combined with the synergist was only about one-twentieth the amount of malathion required for the LD₅₀. (I) Savannah, Georgia.

III-1-C

Insect-Resistant Cotton Bags. Extended storage tests to determine the resistance to insect infestation of cotton bags treated with various deposits of synergized pyrethrins, filled with flour, degermed cornmeal or extra-fine cornmeal and exposed to insects for 1 year were concluded. The types of bags tested were: conventional bags with sewn seams; experimental unlined bags with seams covered with treated-kraft paper; and experimental bags with a waxed-kraft liner, cemented longitudinal seam, and sewn-end closures covered with treated-kraft tape. Of the 11 combinations of treatments and constructions, the synergized pyrethrins-treated cotton bag with waxed-kraft liner, cemented seam, and overtaped-sewn ends was as resistant to infestation as was the standard insect-resistant multiwall kraft bag. Residues found in the three dry cereal products stored in the treated cotton bag with waxed-kraft liners were below legal tolerances throughout the test period. (I) Savannah, Georgia

III-1-C

International Pesticide Specifications. A representative of the Pesticide Chemicals Research Branch, Entomology Research Division, ARS, served as a member of a working party of FOA to develop international specifications for pesticide formulations. Specifications were developed and accepted for parathion, dieldrin, sulfur, sodium chlorate, nicotine, and DNOC. Specifications were tentatively accepted for various formulations of malathion, 2,4,5-T, a BHC-DDT mixture, lindane-DDT mixtures, toxaphene, toxaphene-DDT mixtures, toxaphene-DDT-methyl parathion mixtures, and carbaryl, as well as draft specifications for some formulations of diazinon, thiram, nabam, zineb, and line sulfur. (I) Beltsville, Maryland.

III-1-C

Residue Barriers. Fifteen experimental insecticide formulations or barriers furnished under contract by Battelle Memorial Institute for testing at the Savannah laboratory in an effort to reduce insecticide migration from outside surfaces of treated packages into packaged commodities. These included saran

or polyvinyl alcohol to be used as barriers, and coatings in which synergized pyrethrins was combined with paraffin, polyethylene, carnauba wax, or wax combined with ethylene vinyl acetate copolymer. Barriers appearing to have most promise were polyvinyl alcohol or various weights of saran over a thin film of styrene butadiene. Findings have suggested the evaluation of eight different systems which have been prepared by the contractor. (E) Battelle Memorial Institute, Columbus, Ohio.

III-1-C

Preliminary Evaluation of Insecticides. In screening tests of 58 compounds as insecticides against flour beetle adults and black carpet beetle larvae, 23 compounds that seemed promising were further tested to determine their direct-contact, residual, or vapor toxicity to the insects. Twelve of these promising compounds showed one or more of these toxic properties and will be used in subsequent formulation and developmental studies. The chemicals are American Cyanamid 72016, Bay 75546, Bay 78755, Bay 79330, Bay 79845, Bay 80833, Bay 88991, Cela K-159, Mobil MC-1937, Penick SBP1382, Shell SD15568 and Stauffer R-15552. (I) Savannah, Georgia.

III-1-C

Experimental Fumigation Chamber. An experimental fumigation chamber with controlled environment has been installed at the Savannah laboratory. Operational tests revealed the need for some modifications, adjustments, and minor changes to achieve the required precision of control. These included (1) a larger refrigeration compressor and a change in type of refrigeration gas, (2) an additional modulating valve in the coolant fluid system, (3) addition of more sensitive temperature set-point control instruments, (4) redesign and installation of mountings for the 3-in. diameter specimen probe, (5) construction of housing and installation of a more reliable seal for chamber fan shaft, and (6) addition of a room safety-fan control system. (I) Savannah, Georgia.

III-1-C

Fumigation of Military Plywood Overpacks. Overpacks of bagged flour were successfully fumigated with a dosage of 160 pellets of aluminum phosphid per 1,000 cu. ft. at temperature of about 60° F. with an exposure of 72 hours. The pellets were applied (1) inside the overpack, (2) inside an overpack covered with a 4-mil polyethylene tarpaulin, and (3) under an overpack covered with a tarpaulin. Using the technique of placing the pellets under the polyethylene-covered overpacks at 70° F., mortality of test insects was 100% when (1) 14 pellets per 1,000 cu. ft. (1 pellet per overpack) were used during a 48-hour fumigation, or when (2) 29 pellets per 1,000 cu. ft. (2 pellets per overpack) were used a 24-hour fumigation. Chemical analyses of samples from one replicate fumigated at 160 pellets per 1,000 cu. ft. for 72 hours showed that phosphine residues did not exceed 0.002 ppm on the flour. (I) Savannah, Georgia.

III-1-C

Storage of Piperonyl Butoxide-Treated Kraft Papers. Little piperonyl butoxide was lost during 2 years' storage from a mill roll of kraft paper treated with pyrethrins and piperonyl butoxide. Half the treatment migrated within 3 months from the outer treated ply into the inner untreated plies of stored empty multiwall kraft bags. (I) Savannah, Georgia.

III-1-C

Plant Extracts for Insect Control. Comparative studies of the active principles in the leaves of Neem, *Melia indica*, and Bakayan, *M. azedarach* show that the bitter constituents belong to the same class of compounds, perhaps nor-triterpenoids. (P.L. 480) National Botanic Gardens, Lucknow, India.

III-1-C

Insect Repellents. Of 13 compounds tested for repellency to adult flour beetles, ENT-28740 and ENT-28708 were at least as repellent as the synergized pyrethrins standard.

Polyethylene film impregnated with ENT-25031, a rodent repellent, did not resist penetration by stored-product insects. (I) Savannah, Georgia.

III-1-C

Evaluation of Repellents for Insect-Resistant Packaging. Six compounds for potential use on food packages and as grain protectants were tested for repellency to adult flour beetles. Three compounds, all dimethyldithiocarbamates, were equal to or greater than the synergized pyrethrins standard in repellency. (E) Midwest Research Institute, Kansas City, Missouri.

III-1-C

Resistance of Insects to Insecticides. Four strains of almond moths collected from Georgia peanut and corn warehouses were tested for resistance to malathion. These strains showed 3.1-, 6.6-, 11.4-, and 12.3-fold resistance to malathion when compared with the susceptible laboratory strain.

Three strains of red flour beetles showed 1.5-, 5.0-, and 84.2-fold resistance to DDT when compared with the laboratory strain. The two strains that showed lower resistance were collected in light traps in old peanut shelling plants in Georgia. The strain most resistant to DDT was collected from bags of floor sweepings from one of these plants. This strongly DDT-resistant strain had only 2.4-fold resistance to malathion. (I) Savannah, Georgia.

III-1-C

Analytical Techniques for Residues of New Insecticides. Rapid gas chromatographic methods sensitive to 0.01 ppm or less for 15 new organophosphate and carbamate insecticides and their metabolites have been developed. Two new types of gas chromatographic detectors and a new fiber-optic scanner for thin-layer chromatography that have been developed will greatly facilitate analyses. More efficient methods of extracting the insecticidal residues from plant and animal tissues, milk, soils, etc., also have been devised. (I) Beltsville, Maryland, and Tifton, Georgia.

III-1-C

Analysis of Feeds and Forages for Chlorinated Pesticide Residues. Studies were continued to develop methods for the extraction and cleanup of chlorinated pesticide residues in various types of livestock feeds and forages. Blending samples with chloroform-methanol mixtures appears to give better recovery in some cases than blending with the mixture of isopropyl alcohol and hexane. Good recoveries are obtained during rapid cleanup on carbon-celite and partially inactivated Florisil. (I) Beltsville, Maryland.

III-1-C

Residue Analysis: Immunological Analytical Method. Inoculation of rabbits with synthetic insecticide-protein antigens produced antibodies which reacted directly with the protein and the hapten-protein complex. DDA, derived from DDT, and malathion half-ester inhibited agglutination of their respective hapten-protein complexes, and by this method microgram quantities of these insecticides could be determined. Since direct hemagglutination or precipitation could not be obtained with DDA or malathion, inhibition methods will be necessary to use anti-sera for the analysis of the insecticides. Anti-fibrinogen antibodies are stable to freezing and thawing, but anti-hapten antibodies lose their activity after a few days at 4° C. or at -10°C. General Foods Corporation, White Plains, New York.

III-1-C

Investigation of Insecticide Residues in Milk. When cows were sprayed twice daily with 1 ml of a xylene solution of Compound 4072 at 0.25% or 0.5% concentration, or coumaphos at 0.5% or 1%, neither of these insecticides or their metabolites were detected in the milk. Cows that were fed silage made from corn treated with 0.25 to 1 pound of Dursban per acre did not excrete any detectable Dursban or its metabolite in their milk. When cows were fed silage containing 13 or 23 ppm (wet basis) of Shell SD-8447 no residues were detected in the milk. (I) Tifton, Georgia.

III-1-C

Residue Analysis: Rapid Extraction and Cleanup. An extractor-separator was developed which could be completely automated to proceed through the steps of extraction with proper solvents, and of separation by centrifuging the residues out through the top of the cylinder into a collector ring. Good recoveries were made of less-volatile materials but recoveries of highly-volatile insecticides such as fumigants were poor. It was also demonstrated with the electrolytic conductivity method of selectively detecting chlorinated hydrocarbons is ideal for use with liquid-solid column chromatographic effluents where the cleanup is accomplished mainly on the liquid-solid column. (E) Stanford Research Institute, Menlo Park, California.

III-1-C

Residue Migration - Flour. In small-scale laboratory tests greaseproof paper, glassine paper, saran-coated kraft, and saran-coated polypropylene were effective barriers to the migration of piperonyl butoxide from treated cotton into flour. (I) Savannah, Georgia.

III-1-C

Analytical Methods for Herbicides and Residues. Mixtures containing 2,4-D and 2,4,5-T can be separated quantitatively by using a combination of cation precipitants. Thorium (IV) ions were found to quantitatively remove both 2,4-D and 2,4,5-T from solution; moreover copper (II) ions were capable of quantitatively precipitating 2,4,5-T but incompletely removed 2,4-D. A useful analytical procedure was developed in which advantage was taken of the inability of copper to extensively precipitate 2,4-D. In this differential analysis the total acids are determined as insoluble thorium salts, and the 2,4,5-T is precipitated from a hot ten percent methanol solution as the copper complex. The amount of 2,4-D is evaluated by difference. (E-fg) Indiana Agr. Exp. Sta.

III-1-D

Residue Analysis: Portable Gas Chromatograph. Analytical methods for use with the portable g-c being assembled under contract were further refined. Iso-octane was superior to benzene as a solvent for extracting residues of insecticides from apples and tomatoes. Better results were obtained from supernatant fluid than from pulp plus liquid. These procedures were not satisfactory for wheat and alfalfa hay. Acetone as a macerating solvent was superior. With the 2 procedures, reproducible levels of residues of aldrin, malathion, heptachlor, heptachlor epoxide, dieldrin, endrin, and DDT were obtained from the 4 commodities. One exception was heptachlor on alfalfa hay. Interference with measurement of heptachlor was overcome by using an organic phase of the mixture for analysis. The portable g-c will be available for demonstration and evaluation by regulatory agencies early in F.Y. 1969. (E) Hewlett-Packard Corporation, Avondale, Pennsylvania. III-1-C

Control of Alligatorweed. Applications of granular dichlobenil at 4 lb/A made just prior to or as new growth was beginning in March and April gave good control of rooted emerged alligatorweed in South Carolina. Dichlobenil was not effective on the floating mats or terrestrial growth of alligatorweed. Two or more repeated foliar applications of silvex ester beginning during May to July was the most effective treatment for floating mats of alligatorweed. Foliar applications of silvex and other herbicides at 10 lb/A caused more injury to floating alligatorweed than did 10 ppm of each herbicide (27 lb/acre-foot) applied in water. Applications of 50 ppm (135 lb/acre-foot) in water caused much greater injury to topgrowth but the treatment would be too expensive for general use. (I) Fort Lauderdale, Florida. III-1-D

Carriers and Adjuvants. A study of carriers for the picloram-2,4,5-T combination in Arizona demonstrated that a nontoxic oil emulsion (with a 2,4,5-T ester in the oil phase) was relatively ineffective against mesquite. A 2,4,5-T amine combination with both herbicides in the water phase was more effective although the same herbicides in a straight aqueous carrier were even better. Most effective of all was the picloram-2,4,5-T combination in a carrier of 50% DMSO. Experiments corroborated that significantly enhanced activity was obtained with phenoxy herbicides when carried in the aqueous solution of 40% or more DMSO. Diesel oil or nontoxic oil, combined with equal volumes of DMSO, proved to be effective carriers for a 2,4,5-T ester particularly when emulsified with a relatively lipophylic surfactant. Xylene and glycerine were less effective than the oils in this respect. (I) Tucson, Arizona. III-1-D

Control of Junipers and Oaks. Diesel oil added to picloram in a water carrier speeded initial responses of alligator juniper, Utah juniper, and shrub live oak. Responses of alligator and Utah junipers were similar to those produced by adding 2,4-D to picloram. One seed juniper responses were not affected. Pelleted and granular formulations of picloram applied to the soil killed 95-100% of the top growth of gambel oak one year after application. (I) Flagstaff, Arizona. III-1-D

Control of Perennial Herbaceous Weeds. Seven studies, originally established from 1963-1967, in Nebraska on the control of western whorled milkweed (*Asclepias subverticillata*) were retreated with various herbicides in June 1967. Picloram at 1 to 4 lb/A adequately controlled western whorled milkweed in experiments established in 1964. However, plots treated in 1963 were becoming reinfested. Retreatments resulted in excellent control. Dicamba and 2,4-D were ineffective.

The application of picloram on western ironweed in Nebraska at 1/2 lb/A, or more, effectively controlled top growth soon after treatment and, subsequently destroyed the roots and rhizome. Repeated annual treatments with 2,4-D are required for reduction in stands. (I) Lincoln, Nebraska. III-1-D

Dalmatian Toadflax. Ten-year old Dalmatian toadflax (*Linaria dalmatica*) seed retained viability in dry storage. Toadflax seedlings emerged from a depth of 3 cm. Large numbers of toadflax seedlings were obtained from seeds which had passed through the gastrointestinal tracts of cattle. Roots of Dalmatian toadflax penetrated soil to a depth greater than 8 1/2 ft. Continued herbicide testing showed silvex at 3 lb/A to be the most economical herbicide for Dalmatian toadflax control. Seedlings required 2 1/2 lb/A of silvex for control. Other phenoxy herbicides with the exception of mecoprop were not effective at the same rate. (I) Pullman, Washington. III-1-D

Diquat Effect in Controlling Eurasian Water Milfoil. Treatments of diquat (.25 lb cation per acre) + paraquat (.25 lb cation per acre) applied to Eurasian water milfoil (*Myriophyllum spicatum*) in the spring provided effective control of this species in stillwater areas of impoundment for 5 months. In slow moving waters, a lime treatment applied parallel to water movement was superior in controlling milfoil to a line treatment applied perpendicular to water movement. A hydrosol (interface area between water and soil in pond bottom) sampler was designed, built and operated to obtain samples of this material for herbicide residues and chemical analyses. Samples collected with this device provided comparable residue and chemical data to those obtained from samples collected by diving. A soil residue of several ppm paraquat existed 8 weeks following the above treatments, whereas diquat was not detectable 2 weeks after application. (E-fg) Alabama Agr. Exp. Sta. III-1-D

DSMA Gave Best Control of Johnsongrass. The best control for established johnsongrass was 3 to 6 lb. of DSMA or MSMA per 100 gal. of water applied to wet the foliage at 4-week intervals. Removing topgrowth 4 or 24 hours after treatment did not decrease effectiveness of DSMA. Combining or rotating DSMA treatments with dalapon decreased its effectiveness. (E-fg) Arizona Agr. Exp. Sta. III-1-D

Evaluation of New Herbicides. In research at Beltsville, 39 new herbicides were evaluated in greenhouse and field experiments on more than 20 selected

weed and crop species. One new chemical appears promising for pre- and postemergence weed control in corn. Another chemical appears promising for preemergence weed control in cucumbers, cotton, safflower, peanuts, soybeans, and snapbeans. One new chemical brings about the enlargement of corn root tip cells from 60 to more than 160 microns. These cells are multinucleate. (I) Beltsville, Maryland. III-1-D

Factors Contributing to Effectiveness of Aerial Sprays of Herbicides. In central and eastern Oklahoma factors contributing to poor oak control with 2,4,5-T in order of importance were: (a) application date; (b) air temperature at spraying above 90 F.; (c) spray coverage of 16% or less as measured by sampling cards in the sprayed areas; (d) relative humidity 60% or less; (e) airplane swath width in excess of 50 feet; (f) precipitation of 2" or less one month before spraying; and (g) oak leaves in dry waxy condition. (I) Stillwater, Oklahoma. III-1-D

Florida Elodea Control. Field applications of a combination of diquat at 1 ppm plus copper sulfate at 1 ppm and an amine salt of endothall each gave excellent control of Florida elodea for 5 to 7 months from October treatments and 3 to 5 months from January or April treatments. (I) Fort Lauderdale, Florida. III-1-D

Herbicide Mixtures for Mesquite Effectiveness. A range of ratios of picloram to 2,4,5-T (water-soluble formulations) demonstrated that the activity of 2,4,5-T was markedly enhanced when the overall herbicidal content consisted of 15% picloram. A greater proportion of this compound did not further increase activity on mesquite in Arizona. The herbicidal effectiveness of 2,4,5-T against greenhouse-grown mesquite seedlings was not greatly altered by the addition of amitrole or MSMA to the water phase but was substantially increased with the addition of picloram. (I) Tucson, Arizona. III-1-D

Herbicide-Surfactant Treatments for Control of Nutsedge and Grasses. MSMA, applied in 20 gallons per acre of water containing 0.25 to 0.50 percent of surfactant, effectively controls nutsedge, johnsongrass, and annual grasses. Comparison of results from a relatively dry season with those of a relatively moist, warm season indicates that higher rate of surfactants will be needed in moist seasons. There seemed to be little advantage to using more than 20 gallons per acre of diluent. (I) Stoneville, Mississippi. III-1-D

Mesquite Control. In Arizona, hand spraying field mesquite demonstrated that a 50-50 mixture of the triisopropylamine salts of 2,4,5-T and picloram is more effective than equivalent rates of either the butoxyethanol ester of triethylamine salt formulations of 2,4,5-T, and probably more effective than picloram alone. Of several new herbicides evaluated as soil treatments for control of seedling mesquite, one proved to be particularly effective. It was the emulsifiable concentrate of 1,1-dimethyl-3-(3-[N-tert-butyl-carbamoyloxy] phenyl) urea. At rates ranging from 0.4 to 50 lb/A it caused greater overall herbicidal response than did fenuron. (I) Tucson, Arizona. III-1-D

Nature and Control of Phreatophytes. Combination treatments of mowing saltcedar in early spring or late summer followed by one or two spray applications of silvex ester at 2 lb/A on young regrowth produced greater reductions in stand at lower cost than any single or combination treatments previously tested.

Saltcedar foliage and bark were found to contain considerable tannin which interfered with extraction of protein and may be a factor in the response of saltcedar to herbicides. A treatment of 10% FeCl_3 , which reacts with phenolic compounds, stimulated sprouting from dormant buds at the basal areas of treated shoots and on the parent cutting. (I) Las Lunas, New Mexico. III-1-D

Reduction of Herbicide Residues by Use of Adjuvants. Dacagin, Norbak, and Vistik were found to significantly reduce spray drift of herbicides. These adjuvants did not reduce selectivity of several herbicides in several crops. They did not prevent loss of herbicides from plant leaves from washing or evaporation. Results would indicate that these materials will be helpful for use in Oregon. (E-fg) Oregon Agr. Exp. Sta. III-1-D

Reed Canarygrass. Fall applications of sodium trichloroacetate (TCA) at 20, 40, and 80 lb/A gave satisfactory control of reed canarygrass in Montana and Washington experiments. Fall applications of the more expensive dalapon at equivalent rates were significantly less effective. However, repeated foliar applications of dalapon alone or mixtures of dalapon or amitrole-T and TCA were more effective than foliar applications of TCA alone. (I) Bozeman, Montana, Prosser, Washington. III-1-D

Herbicides for Spring Parsley Control. Picloram, a mixture of picloram and 2,4-D and amines and esters of 2,4-D and 2,4,5-T used separately controlled spring parsley in southern Utah. Picloram and a mixture of picloram-2,4-D provided over 99% control at $\frac{1}{2}$ lb/A. The phenoxy herbicides were equally effective at 1-2 lb/A. (I) Logan, Utah. III-1-D

White Waterlily. Dichlobenil applied at 7.5 and 15 lb/A as 4% granules, when white waterlily (*Nymphaea tetragona*) was just beginning new seasonal growth, gave 99+% control of the weed at both rates. No injury or death of fish was observed. No submersed weeds developed in the treated areas as commonly occurs when phenoxy herbicides are used to control waterlilies. (I) Prosser, Washington. III-1-D

Chemical Control of Nematodes. At 7 field stations, a number of new chemicals show promise as being equal to, or better than, existing halogenated chemicals such as DD, EDB, and DBCP. The most promising are Temik, Furadan, Mocap, Dasanit, Bay 68138, Lannate, and SD 7727. Mixtures of SD 7727 with DBCP and DD as technical materials and emulsifiable formulations gave outstanding nematode control, which persisted for longer periods than halogenated hydrocarbon nematocides alone. Most of the new chemicals are organophosphates, or carbamates, that can be sprayed onto or can be mechanically incorporated into soil. These chemicals can be effectively combined with herbicides and fungicides for use on other crops. (I) 7 Locations. III-1-F

Soil-Free Evaluation of Nematocides. At Beltsville, a soil-free technique was developed to make direct observations on roots to determine the activity of test chemicals as nematocides, attractants, repellents, or systemics. Maleic hydrazide and several other chemicals of a benzoic acid type provided systemic control of nematodes under these conditions. Evaluations of many candidate chemicals indicates that one group of 33 compounds have systemic nematocidal characteristics. (I) Beltsville, Maryland III-1-F

Animals

Area Spray Tests for Control of Lone Star Ticks. High volume (50 gal/acre) sprays of Dursban, diazinon, Bay 39007, fenthion, naled, carbaryl, Shell SD-8520, Mobam, and DDT at the rate of 1 lb/acre all provided 84% or greater control of lone star ticks in plots at Camp Lejeune, N. C. Ultra-low volume tests of fenthion applied by helicopter at the rate of 2 lb/acre provided 95% control under very unfavorable weather conditions. Ultra-low volume treatments with ground equipment were superior under these same conditions, giving 93% control with 0.5 lb/acre of fenthion and 89% with 0.5 lb/acre of Bay 39007. (I) Gainesville, Florida. III-21-C

Control of Animal Parasites. Dust bag treatments of Co-Ral and Tiguvon gave almost 100% effectiveness against horn flies. Backrubber treatments were also effective but required more time and effort. Pour-on treatments against horn flies were effective for much shorter periods. Mineral and protein mixtures were not effective against horn flies. Pour-on treatments were totally effective against cattle grubs and the long nosed cattle louse. Some indications were obtained of grub control from dust bag treatments. Louse control was obtained in one week using 5% Co-Ral dust bags on cattle heavily infested with the little blue louse. Tick control was not obtained by the use of 5% Co-Ral dust bags in an area heavily infested with the Lone Star Tick. (E-fg) Arkansas Agr. Exp. Sta. III-21-C

Automatic Cattle Sprayers. Improvements on an ultra-low volume automatic cattle sprayer resulted in better performance and increased reliability. A 0.5 percent Ciodrin solution applied at a rate of one ml. twice daily is sufficient to control horn flies on dairy cattle. Xylene solutions of coumaphos (0.5 percent and one percent), Shell-4072 (0.25 percent and 0.5 percent), and Shell-8447 (0.5 percent and one percent) applied at a rate of one ml. twice daily to dairy cows provided horn fly control without detectable residues in the milk. Methoxychlor (one percent and two percent xylene solutions) applied in the same manner produced residues (0.001 ppm to 0.010 ppm) in the milk of treated cows. (I) Kerrville, Texas. III-21-C

Cattle Insect Control. Ultra low volume (ULV) aerial applications of naled, trichlorfon, Baygon and combination of fenthion and Baygon resulted in rapid knockdown of adult mosquitoes. Baygon applied in water and in combination with fenthion showed no advantage over Baygon ULV alone. Trichlorfon shows great promise as it did control larvae as well as adults and has clearance for use in livestock as well as other crops. A new insecticide application method $[(SiCl_4) + \text{insecticide}] + (NH_3 + H_2O) \rightarrow (SiO_2(s) + \text{insecticide}) + (NH_4)Cl(s) + \text{insecticide}$ that may be useful for fly and other insect control was found to be successful against mosquitoes. Low volume of insecticidal dusts, applied to cattle by self dusters, proved effective against the horn fly and reduced face fly populations. (E-fg) Kentucky Agr. Exp. Sta. III-21-C

Fly Control Increased Weight Gains. A group of 12 animals were sprayed with 0.5% methoxychlor every 3 weeks during a period of 12 weeks. Eighteen untreated animals shared the pasture. At the end of the period, treated cattle had gained an average of 1.41 lb/day and untreated 1.14 lb/day. (I) Stoneville, Mississippi. III-21-C

Safer Mothproofing Agents Sought. Gardona is of special interest because of its effectiveness and low mammalian toxicity. In followup studies with Gardona, temperature of the application bath was more important than immersion time or pH. The best protection against insect feeding occurred after treatment in an alkaline bath below 110° F. Exhaustion of Gardona from the bath was rapid. In practical home-type treatments, a bath concentration of 0.01% Gardona in the second rinse satisfactorily protected cloth against black carpet beetle larvae. About 50% of the Gardona was recovered when applications ranged from 0.02 to 0.04%.

Bay 77488 at a bath concentration of 0.005% protected woolen cloth against feeding by insects, regardless of length of immersion, temperature, or pH.

Bath temperature studies with Ciba C-9491 at a concentration of 0.0025% indicated that a temperature of 75° F. produced the most effective treatment. (I) Savannah, Georgia. III-21-C

Response of Flies to Infrared Radiation. Facilities were prepared for determining the flight activity of stable flies in response to low energy infrared radiation. Infrared radiation, visible radiation, temperature, and humidity could be independently controlled. Preliminary tests indicated that stable flies do not respond to incident radiation at less than 0.15 Btu/ft.² x hr., with peak energy at 9.2 microns. There were slight indications of response at greater radiation levels. (I) College Station, Texas. III-21-C

Residual Sprays Affected by Surfaces Treated. The effect of surfaces of various building materials on the residual toxicity of malathion to the black carpet beetle is being investigated. Malathion applied to vinyl tile, clay brick or cement surfaces was not toxic to the black carpet beetle larvae. Malathion was evaluated for effectiveness on various coating agents.

One g. of malathion/m² was ineffective on all surfaces tested. Two g. of malathion/m² was effective for at least 20 weeks on the talc and calcium carbonate coatings, but not on the others tested. Several oils were toxic to black carpet beetle larvae on nonporous surfaces. The oils showing toxicity included vegetable, mosquito larvicidal, and crop-spraying oils. (E) University of Wisconsin, Madison, Wisconsin. III-21-C

ULV Versus High-Volume Aerosols. In tests against mosquitoes ULV non-thermal aerosols of malathion and naled were indicated to be superior to high volume thermal aerosols. (I) Gainesville, Florida. III-21-C

Sorption of Quaternary Ammonium Compounds by Wool. Aliquat 336 applied to woolen cloth by a sorption treatment at add-ons of 0.15 to 0.50% by weight furnished satisfactory protection against larval feeding of 2 insect species in precleansing tests and after the residues had aged 9 months. Cloth treated in a conventional textile padder to contain 0.41% by weight was protected against insects before cleansing and after three washings or three drycleanings. Aqueous spray treatments at 0.6% by weight protected woolen cloth before and after one washing or drycleaning. Sorption treatment of loose wool at an add-on of 0.42% satisfactorily protected the wool against larval feeding. Loose wool treated at 0.6% by weight was also satisfactorily protected after carbonizing. Sorption treatment of carpet yarn at 0.42% by weight also satisfactorily protected the yarn against both species. When Aliquat 336 was applied in the last rinse bowl during raw wool scouring at 0.78% by weight, the wool was satisfactorily protected after scouring, carding, and combining. (E) Harris Research Laboratories, Inc., Washington, D. C. III-21-C

Application of Herbicide to Prevent Tall Larkspur (*Delphinium barbeyi*) Poisoning. Mixtures of .25% and .5% low volatile 2,4,5-T(2,4,5-trichlorophenoxyacetic acid) in ammonium sulfate on per weight basis of active ingredients in herbicide were sprinkled around the base of individual tall larkspur plants in the fall. Good to excellent control was obtained on all plots. In the following spring an excellent growth of grass had started to cover the dry, bare area where the larkspur plant had previously been growing. (I) Logan, Utah. III-21-D

Candidate Acaricides for the Control of Scabies Mites on Sheep and Cattle. From a variety of acaricides tested against *Psoroptes ovis*, the scabies mite of sheep and cattle, two drugs stand out prominently -- Prolate (O,O-dimethyl S-phthalimidomethyl phosphorodithioate) and ciodrin (lphamethylbenzyl 3-hydroxycrotonate dimethyl phosphate) (formulated as Cio-Rid, Wm. Cooper and Nephews). Both compounds have undergone exhaustive trials for the third year; during 1967-68, over 300 sheep, infested with vigorous strains of mites, were involved. While Prolate presented host toxicity problems associated with certain e.c. formulations, the drugs, eminently successful as scabicides, are welcome additions to a field which has, in recent years, been drastically narrowed. Expanded tests with these agents against scabies of cattle are now in order. (I) Albuquerque, New Mexico. III-21-E

Chemical Control of Cattle Lungworms. Promising data on chemical control of the cattle lungworm, Dictyocaulus viviparus has been obtained in naturally infected cattle treated with Ronnel. Preliminary data with a new chemical laevo-tetramisole, also indicates possible action against lungworms. Studies are continuing to obtain additional evidence on the value of these chemicals in lungworm control and on the most practical and effective means of application. (E-fg) Florida Agr. Exp. Sta. III-22-E

1-tetramisole an Effective Anthelmintic. A drench and a bolus formulation of 1-tetramisole were tested in 30 cattle under field conditions. The drench (8 mg./kg. body weight) and the bolus (5.4 mg./kg. body weight) were 94-100% effective against the common nematode parasites in Georgia. There was no evidence of intoxication. (I) Experiment, Georgia III-22-E

Beneficial to Treat Beef Cattle Before Pasturing. Stocker beef cattle should be treated for nematode parasites before placement on a clean pasture. Steers treated with thiabendazole at the beginning of the test made better weight gains and had lower number of worms postmortem. (I) Experiment, Georgia. III-22-E

Ear Ticks of Cattle. Several acaricidal compounds, variously formulated, were tested against spinose ear ticks (Octobius megnini) of cattle. Coumaphos, 3%, in a petrolatum base, was found superior to a 3.5% lindane/pine/oil/xylene aerosol bomb, and to preparations containing ciodrin. Dursban, 2.5% in petrolatum, proved more effective than lindane, coumaphos, or ciodrin (in that order) identically formulated. Acaricidal capabilities not being in question, the criteria for measuring the effectiveness of the compounds was based on their ability to repel larval invasion and prevent nymphal survival, under conditions of maximum population pressure. The Dursban/petroleum jelly formulation provided 15 days absolute protection against returning larvae, and 28 days against the first surviving nymph. (I) Albuquerque, New Mexico. III-22-E

Maretin and Baymix Crumbles Efficacious Anthelmintics. Critical tests using four steers indicated that Maretin, as a drench at the rate of 50 mg./kg. body weight was highly effective against nematodes. In another trial, a dose level of 2 mg./kg. of Baymix Crumbles, given for six consecutive days, was also highly efficacious. Neither drug was intoxicating. (I) Experiment, Georgia. III-22-E

DDT Residues in Poultry Products. When hens were given a single oral dose of 10, 15, or 20 ppm of DDT, the concentration of the pesticide and its metabolite DDE reached maximum level in the tissues from three to five weeks after administration. Abdominal fat contained 3 to 4 ppm 11 weeks after exposure. Small amounts of the pesticide were detected in breast muscle, leg muscle, liver, kidney and brain eight weeks after dosage. The use of phenobarbital and 3-methylchoranthrene as inducing agents for the stimulation of liver microsomal enzyme had no effect on the rate of DDT metabolism. (E) University of Georgia. III-24-C

Effectiveness of Piperazine Citrate Against Poultry Parasites. Piperazine citrate given at a level of 0.4% (base) in feed for 2 days was 100% effective against adult Ascaridia dissimilis, moderately effective against adult Capillaria obsignata, and ineffective against immature Ascaridia and adult Heterakis gallinarum in turkeys. (I) Beltsville, Maryland. III-24-E

Dichlorvos Impregnated Bands Control Poultry Lice. Resin strips impregnated with 5 or 10% dichlorvos were attached to wings or legs of chickens infested with lice. Control of lice was essentially complete by 3 days posttreatment. Also lice were controlled by attaching 5 or 10% dichlorvos impregnated strips to the bottom of cages housing the birds. (I) Kerrville, Texas. III-24-C

Chemical Control of the Intestinal Threadworm in Swine. Both natural and experimental infections with the intestinal threadworm, Strongyloides ransomi, in suckling pigs were effectively controlled with aqueous formulations of thiabendazole. Sesame oil suspensions of this anthelmintic were not effective upon injection. Inclusion of thiabendazole in the feed of a 0.1 percent level was effective in clearing adult threadworms from weanling pigs. (E-fg) Florida Agr. Exp. Sta. III-25-E

Insecticides for Control of Tropical Horse Tick. Four compounds have been indicated to be highly effective against the tropical horse tick, Anocentor nitens. Compound 4072, isobenzan, Shell SD-8448, and Niagara Nia 9227 killed adult ticks at 0.001% of each. (I) Kerrville, Texas. III-27-C

Parasite Resistance to Thiabendazole. Accumulating evidence indicates that resistance of horse strongyles to thiabendazole is becoming more widespread in Central Kentucky. To circumvent this problem it has been found that the addition of piperazine to thiabendazole provides effective treatment. Also there has been no evidence of a cross-over of the resistance to phenothiazine-piperazine mixtures. (E-fg) Kentucky Agr. Exp. Sta. III-27-E

Boric Acid Residues as Toxicants Against Cockroaches. Boric acid powder applied to wood panels at 500 mg/929 cm² produced 100% mortalities of German roaches for at least 8 weeks and 95% for 12 weeks. (I) Gainesville, Florida. III-28-C

Field Crops

Insect Control on Field Crops. The addition of an air stream for a pesticide carrier on ultra low volume spray nozzles improved insect control on sweet corn when light infestations occurred. One pint of malathion per acre was as effective as a two pound application of DDT in a hydraulic spray. Boll weevils were controlled as effectively on small cotton plants using ultra low volume spray equipment with narrow angle spray nozzles as with conventional spray equipment using large volumes of water. (I) Tifton, Georgia. III-31-C

Control of Weeds in a Rotation of Peanuts, Cotton, and Corn. Corn yields from plots receiving maximum use of herbicides were 21 and 18 percent higher than yields from plots that were cultivated or those that received minimum use of herbicides, respectively. Yields of peanuts on maximum-use herbicide plots were 31 and 20 percent higher than from cultivated and minimum-use herbicide plots, respectively. Maximum use of herbicides controlled weeds best in peanuts and corn, and more economically in cotton as compared with minimum use of herbicides and cultivation. In the second year, considerable injury to peanuts resulted from residues of herbicides applied previously for the control of weeds in corn on the maximum-use herbicide plots. (I) Tifton, Georgia.

III-31-D

Herbicide Application Equipment. Equipment was developed to apply herbicides as a foam. A stream of high-velocity air is mixed with a stream of liquid from a flat fan spray nozzle and directed through rubberized pig hair to produce relatively drift-free foam. A tractor mounted plot sprayer was developed for testing large numbers of post emergence chemicals for weed control. Tests using water and dye showed little or no contamination occurring when chemicals are changed. Several types of hose pumps were tested to determine metering accuracies. The liquid flow from these pumps is in the form of solid streams or large droplets and the flow rate is proportional to ground speed. Atomizing air streams at the end of the hoses are proposed for producing spray patterns. (I) Stoneville, Mississippi.

III-31-D

Herbicide Rotations. In Illinois, corn, soybeans, and wheat were grown continuously in several locations for 3 years. Herbicide-treated plots of corn and soybeans out-yielded those in which cultural practices only were used; wheat yields were not affected by method of weed control. Crop stands were not affected by herbicide residues in the soil within the 3-year period. Crabgrass and velvetleaf appeared to be increasing in proportion to other weeds in continuous corn where only atrazine was used. Morningglory increased over other weeds in soybeans where only amiben was used. Where herbicides were rotated, no weed species appeared to be increasing. Herbicides controlled the weeds more effectively than cultural practices alone. (E) Urbana, Illinois.

III-31-D

Performance of Herbicides Under Certain Conditions. SD-11831 (Planavin), a preplant herbicide commercially available for use in cotton, was found to undergo an apparent chemical change within 4 days in moist soil. Prior to this change, SD-11831 prevented the growth of the taproots of cotton seedlings; after the change, taproot growth was unaffected. The potential injury of the herbicides Planavin and Treflan to cotton was borne out. (E-fg) New Mexico Agr. Exp. Sta.

III-31-D

Cleanup Procedure for Analysis of Pesticide Residues in Grains. A rapid micromethod of sample cleanup for gas chromatographic analysis of insecticidal

residues in grain, and other plant, animal, soil and surface and ground water extracts, was devised. A simple microcolumn chromatographic cleanup method for chlorinated and organophosphorus insecticides has been developed, in which a high purity grade 950 of activated silica gel (60-200 mesh) is used. Insecticides are selectively eluted from the adsorbent by different solvent mixtures, varying in polarity. Cleanup is satisfactory for gas chromatographic analysis. All tested insecticides were recovered quantitatively. (E-fg) Kansas Agr. Exp. Sta. III-32-C

Farm-Stored Grain Insect Pests. Accomplishments: A survey of farm-stored grain and soybeans, involving 72 farms distributed throughout Delaware indicated the following stored crops: ear corn on 87% of the farm, shelled corn 2.8%, barley 26%, oats 15%, soybeans 12%, wheat 2.8% and rye on 1.4%. No insects were found in the shelled corn, soybeans, or rye, but 63.5% of the ear corn storages were infested with the Angoumois grain moth, an insect also found in barley and oats. Other insects causing damage to ear corn, barley, oats and wheat, in order of frequency of infestation, were: the cadelle, sawtoothed grain beetle, granary weevil, confused flour beetle and Indian meal moth. (E-fg) Delaware Agr. Exp. Sta. III-32-C

Copper Fungicides Correct Copper Deficiency in Wheat. Work in recent years on a crop failure in wheat in certain sections of eastern North Carolina showed that it was due to copper deficiency. This condition was much more severe in wheat following tobacco than in wheat following corn and was not noticable in wheat following sweet potatoes. A normal crop of wheat was produced when 20 lbs/A of copper sulfate was applied to the soil. In the past 2 years, treatment of wheat seed with copper fungicides at the rate of 4 ounces per bushel was as effective as application of 20 lbs/A of copper sulfate to the soil in correcting the copper deficiency. Copper carbonate and cuprous oxide were equally effective, both in small replicated plots and in drilled strips through farmers' fields. (E-fg) North Carolina Agr. Exp. Sta. III-321-B

Insects and Mites Attacking the Growing Wheat Plant. Endrin remains the most effective insecticide available for pale western cutworm control. Some of the newer, experimental materials are effective and may not leave prolonged residues. Dursban, Geigy 13005, dimethoate, Shell 9129, Dasanit, and ethion provided good control of brown wheat mite for 11 days. Several provided longer control than the parathion standard. None significantly. (E-fg) Kansas Agr. Exp. Sta. III-321-C

Insect Control in Bulgur. Dosage rates of 2 pounds of hydrogen cyanide, 2 pounds methyl bromide, and 165 aluminum phosphide pellets per 1,000 cubic feet gave complete kills of mature and immature stages of insects in bulgur. One fumigation with HCN resulted in a residue 294 p.p.m. (allowable tolerance 90 p.p.m.). Three fumigations with methyl bromide resulted in a 56 p.p.m. residue (allowable tolerance 125 p.p.m.). Three

fumigations with PH_3 resulted in a .005 p.p.m. residue (allowable tolerance 0.1 p.p.m.). (E) Kansas State University, Manhattan, Kansas.

III-321-C

Protectants for Wheat. Gardona, 5% malathion in a granular carbon formulation, and a low-volume malathion emulsion treatment protected wheat in small bins from insect attack for 12 months. (I) Manhattan, Kansas. III-321-C

Treatments for Wheat Studied. Packaged food products in contact for 7 days with inside surfaces of railway freight cars treated with a 2 1/2% solution of dichlorvos and malathion contained dichlorvos residues of less than 0.1 p.p.m. Fumigation of empty boxcars with 165 pellets of aluminum phosphide per 1,000 ft.³ killed 100% of test insects. Applications of malathion to newly harvested wheat by farmers using standard techniques showed wide discrepancies in amounts of insecticide actually applied--in some instances 1/50th the amount required for satisfactory insect control. (I) Manhattan, Kansas.

III-321-C

White-Fringed Beetle Control. Adult white-fringed beetles confined on dichlorvos-treated wheat survived 22 days and deposited eggs in grain during the first 10 days. Some of the eggs deposited on dry wheat and held for 2 months were still viable. (I) Savannah, Georgia. III-321-C

Control of Weeds in Rice. Postemergence applications of molinate in Arkansas controlled grass weeds effectively and selectively in rice for the third successive year. This new herbicide was recommended for practical use for the first time in the spring of 1968. Mixtures of herbicides or combinations of different herbicides applied at different times continued to control weeds better than single herbicides applied once. An early application of propanil followed by 2,4,5-T at midseason controlled grass, broadleaf, and aquatic weeds more effectively than single herbicides which controlled either grass or aquatic weeds. Higher yields of rice were produced with the combination treatment than with the single treatments. (I) Stuttgart, Arkansas.

III-324-D

Propanil Mixtures in Rice. Mixtures of propanil with either of two developmental herbicides (each chemical at half the normal rate) controlled grass as well as propanil at the full normal rate of application. KN_3 controlled aquatic weeds effectively but mixtures of the KN_3 with propanil provided better control than either herbicide used alone. Rice growing under stress from cool temperatures and low soil pH was injured by KN_3 or mixtures of KN_3 with propanil; rice grown in a favorable environment was not injured. Drill-seeded rice seemed more susceptible to injury from the KN_3 -propanil mixtures than water-seeded rice, especially on silt loam. Mixtures of propanil and 2,4,5-T at low rates, for the third consecutive year, controlled aquatic weeds in water-seeded rice as well as high rates of either herbicide applied alone. (I) Stuttgart, Arkansas.

III-324-D

Bulk Corn Treated with Aerosol. Amounts of malathion lethal to insects were deposited throughout corn masses in 14- and 26-foot columns of grain using thermal aerosols and forced airflow. Reversing airflow and introducing aerosols at top and bottom gave effective insect control at reduced dosage levels. Gas chromatography analysis in field-scale corn fumigations indicate that both carbon tetrachloride and ethylene dichloride applied by gravity rapidly penetrate warm corn masses. Ethylene dichloride penetrated more readily in warm corn than in either wheat or grain sorghum.
(I) Manhattan, Kansas. III-326-C

Control of Corn Borer. Control of first-brood European corn borer was not improved when the rate of application of DDT and diazinon was increased to compensate for different row spacings and plant populations. Systemic insecticides placed 10 inches to the side of the corn plant and two to four inches deep with mechanical cultivation gave better control than applications at planting time with or near the seed. Both liquid and granular formulations of Bacillus thuringiensis gave good control of first-brood corn borers. Some liquid formulations tested would not stay in suspension and could not be applied as sprays. Some granular formulations were not adequately sized and could not be metered accurately. Formulations must be improved or equipment redesigned to obtain acceptable Bacillus applications. (I) Ames, Iowa. III-326-C

Control of Corn Insects. A granular insecticide was incorporated to various depths by several types of tools. Best corn yields were obtained from surface incorporation by a scraper blade tool which spread the granules in a band six inches wide over the planter row. Yield, root rating, and reduction of rootworm larvae population were significantly improved in Furdan-10g and Aldrin-20g treatments. Liquid sprays of Baygon, carbaryl, diazinon and malathion applied to the ear zone for control of adult northern corn rootworm each reduced population by at least 96 percent. Yields were significantly increased in each treatment compared to an untreated plot. A laboratory study of granular applicators showed considerable variations in material distributed down a row even though total flow over a timed period may indicate a uniform feed rate.
(I) Wooster, Ohio. III-326-C

Control of the European Corn Borer and Corn Rootworms. The feasibility of using combination control for European corn borers and corn rootworms in eastern Nebraska was studied during 1967. Results showed that susceptible stages of both insects are well enough synchronized that partial control can be obtained. Combination treatments should be timed to control the most serious pest and any control of the other should be considered a bonus.
(E-fg) Nebraska Agr. Exp. Sta. III-326-C

Southwestern Corn Borer Control in Alabama. Annual surveys for the southwestern corn borer, Zeadiatra grandiosella (Dyar) indicate that 34 counties in Alabama are infested. Field evaluation of insecticidal and cultural control of the southwestern corn borer indicated that the most effective control measure at present is planting date. Corn in northwest Alabama that was planted before May 1 was much less damaged than that planted later. In the use of insecticides such as endrin, timing of the applications was found to be very important. (E-fg) Alabama Agr. Exp. Sta. III-326-C

Sweet Corn Resistance to Corn Earworm. Four new lines of sweet corn were evaluated for corn earworm resistance. This is an attempt to integrate chemical control with plant resistance to insects. Not only did these four lines show resistance but the results indicated that resistance at least in part may be attributed to silk balling and possibly husk tightness. (E-fg) Maryland Agr. Exp. Sta. III-326-C

Chemical Weed Control. Directional spray equipment showed no effect on weed control in corn with Lorox and Clobber. Leaf lifters reduced damage when corn was less than 12 inches high. Directional and overall applications of Atrazine and of oil gave equally effective weed control in corn rows. Surface applications of Sutan-D were equal to incorporation with a rotary tiller or injected beneath a sweep in controlling weeds in corn. Analysis of soil core samples showed that a rotary tiller distributed trifluralin in the top inch of soil and that disking placed most of the chemical at one-half the working depth of the tool in a non-uniform pattern. (I) Columbia, Missouri. III-326-D

Control of Witchweed in Corn. Investigations in North Carolina indicate that the herbicide pyriclor will be useful for selective control of witchweed in corn. In addition, tobacco appeared tolerant to the herbicide. (I) Whiteville, North Carolina. III-326-D

Grasses and Other Weeds in Corn. In Mississippi, a combination of dalapon plus MSMA applied to the foliage of emerged johnsongrass before planting of corn controlled johnsongrass from both seedlings and rhizomes without injury to corn. Combinations of 2,4-D with either atrazine or linuron provided excellent control of grasses and broadleaf weeds when applied to emerged weeds before planting of corn. (I) State College, Mississippi. III-326-D

Combinations of Propachlor and Linuron Gave Excellent Weed Control in Corn. Combination of propachlor with linuron or atrazine showed excellent weed control and high yields in corn. In soybeans the mixture of propachlor + linuron effectively controlled most weeds. Linuron + surfactant and clobber applied as directed postemergence treatments showed effective weed control in corn. Linuron was especially effective against some of the larger grasses. Trifluralin and nitralin both showed effectiveness in controlling wild cane in soybeans at the one pound rate. Soybean growth and response to trifluralin at various soil temperatures revealed significant reduction in rate of emergence. (E-fg) Missouri Agr. Exp. Sta. III-326-D

Herbicide Application Practices. Mechanical incorporation of herbicides in the soil for weed control in corn and soybeans showed little benefit from incorporation. Directional and overall spray applications of Atrazine and of oil were equally effective, and both gave excellent weed control in corn when followed by mechanical cultivations. Analysis of soil and water samples from controlled runoff plots showed some loss of pesticides in both soil and water. (I) Ames, Iowa. III-326-D

Herbicide Coated Granules Evaluated. In field test amiben and linuron performed better on coated mineral base granules than commercial formulations. Release rate studies conducted in the laboratory indicated that Ruberoid granules of amiben and linuron released about 50% to 60% of their active ingredient during the first two days; most of the remaining active ingredient was released during an eight day period. Commercial amiben granules (attapulgate) released over 90% of their active ingredient in two hours. Commercial linuron granules were not available. (E-fg) Maryland Agr. Exp. Sta. III-326-D

Herbicides for Witchweed and Other Weeds of Corn. In North Carolina, several new chemical compounds, chemically related to 2,4-dichlorophenoxyacetic acid, were synthesized and evaluated for control of witchweed and other weeds associated with corn production. Some of the compounds controlled witchweed as well as 2,4-D and in addition controlled crabgrass better than either atrazine or 2,4-D. Some of the compounds controlled several weeds as well as 2,4-D and for longer periods. Thirteen of the new herbicides were more effective than 2,4-D in controlling pigweed. (I) Whiteville, North Carolina. III-326-D

Control of Bird Depredation. TEM (Triethylenemelamine) dissolved in water and mixed with cracked corn was placed on platforms in a Red-winged Blackbird nesting area. One hundred and thirty nests were observed in the test and control areas. Thirty-nine percent of the eggs in the test area were inviable showing definite effects of the chemosterilant on breeding success. (E-fg) Maryland Agr. Exp. Sta. III-326-G

Treatments for Grain Sorghum Studied. Two pints of 57% malathion emulsion applied to 1,000 bushels of grain sorghum as an undiluted ultra-low volume spray and as a high volume water-diluted spray gave excellent protection against insect damage. Malathion and diatomaceous earth mixed together protected the grain from insects better than either material applied separately at equivalent dosage rates. In recent field tests with 80:20 (CCl₄:CS₂) and 75:25 (CCl₄:EDC), gas chromatography analysis indicated that the components separate and present a fire hazard. These two fumigants should not be recommended for use on grain sorghum regardless of temperature, unless they are recirculated. (I) Manhattan, Kansas. III-327-C

Foam as a Pesticide Carrier. Equipment and techniques have been developed for applying growth inhibitors carried in foam to tobacco plants to control flower and sucker growth. Twelve foaming solutions were tested as carriers for three growth inhibitors. (I) Beltsville, Maryland. III-328-G

Oxidative Detoxification of Enzymes. Comparisons on the epoxidation of heptachlor were made between different stages within species and between species of stored-product insects. In Trogoderma parabile the greatest differences in ability to epoxidize heptachlor were found between males and females and between females of two different culture strains. Epoxidation was lower in larval stages than in adults. There were no significant differences between larvae of different ages nor between adult females of different ages. (E) Iowa State University, Ames, Iowa. III-31-C

Pesticides and Plant Management. At the USDA Plant Materials Centers, techniques in the use of pesticides continued to be studied in FY 1968 to improve the establishment, management, and seed production of plants for soil stabilization, erosion control, windbreaks, wildlife areas, and beautification. (I) Washington, D.C., and regional nurseries. III-33-A

Alfalfa and Lespedeza. In Missouri, postemergence treatments of 1 and 2 lb/A of MSMA did not reduce yields of alfalfa and controlled lambsquarters (Chenopodium album), smartweeds (Polygonum spp.); foxtail, other warm season grasses, and waterhemp (Acnida spp.), but failed to control ragweed (Ambrosia spp.). Yields of lespedeza forage were greater from plots treated with $\frac{1}{2}$ and $\frac{3}{4}$ lb/A of chloroxynil than yields of plots treated with $\frac{1}{2}$ and $\frac{3}{4}$ lb/A of bromoxynil or 1 lb/A of 2,4-DB. Yields and germination of lespedeza seed were not affected by up to 1 lb/A of chloroxynil, bromoxynil, 2,4-D amine, and 2,4-DB ester. (I) Columbia, Missouri. III-33-D

Birdsfoot Trefoil and Crownvetch. In an established stand of birdsfoot trefoil (Lotus corniculatus) in Missouri, 1 lb/A of atrazine, 1 and 2 lb/A of simazine, $\frac{1}{2}$ and 1 lb/A of bromacil, and $\frac{1}{2}$ lb/A of terbacil, applied in March, controlled yellow rocket (Barbarea vulgaris), curly dock (Rumex crispus), weed bromegrasses, and Erigeron spp. without injury to the birdsfoot trefoil. Four lb/A of CIPC and 2 lb/A of atrazine, applied in March, injured birdsfoot trefoil.

Crownvetch (Coronilla varia) established in 1966 in Missouri with 1 lb/A of trifluralin, 1 lb/A of benefin, and 4 lb/A of 64-296-B yielded more than 6,000 pounds of oven-dry forage in 1967. (I) Columbia, Missouri. III-33-D

Weed Control in Seedling Legumes. Paraquat in combination with tillage operations before seeding of legumes in New York was determined to have considerable potential for controlling Agropyron repens and Cyperus esculentus as well as annual broadleaf weeds and grasses. Combination herbicide treatments of (a) EPTC + bromoxynil; (b) propachlor + 2,4-DB; (c) bromoxynil + dalapon; (d) 2,4-DB + dalapon; and (e) DNBP + dalapon, were outstanding in giving season-long weed control during establishment of legumes. (I) Ithaca, New York. III-33-D

Systemic Fungicides Provide Disease Control in Grass-seed Crops in Lieu of Burning. A fungicide applied to the soil gave complete control of blind seed disease and ergot for the first time by a systemic fungicide. Flag and stripe smut diseases were eradicated or suppressed for long periods in Merion Kentucky bluegrass by chemicals with fungistatic properties. (I) Corvallis, Oregon. III-331-B

Insects and Seed Production of Legumes and Grasses. Appreciable resistance to *Lygus* and alfalfa plant bugs was observed in 10 to 15% of the 123 *Medicago* accessions screened in 1967. Malathion and diazinon gave good control of silvertop of bluegrass. Carbaryl gave good control in 1966 but was no more effective than untreated checks in 1967. Our results emphasized the importance of timing insecticide applications at the early heading stage. The meadow plant bug reduced seed yields of bluegrass when it was introduced into field cages at a ratio of 1 bug per 6 heads. At a ratio of 1 bug per head there was an 80% loss in seed. In contrast, 10 grass thrips per head caused no significant loss in yield. Populations of the meadow plant bug in timothy fields were low and could not be related to age of the stands. Meadow plant bugs placed on timothy in field cages 2 weeks before heading did not decrease yields. (E-fg) Minnesota Agr. Exp. Sta. III-331-C

Control of Downy Brome in New Seedlings of Perennial Grasses. Density of downy brome (*Bromus tectorum*) in the seed-bed was reduced most by spraying with paraquat followed by furrowing and seeding perennial grass. Downy brome was least reduced with no weed control treatment and surface drilling. Seedling stands of intermediate wheatgrass (*Agropyron* spp.) varied from .3 plants per foot (surface drilled only) to 3.4 plants (sprayed with paraquat and furrow seeded). Severe and rapid depletion of moisture occurred in the top 3" of soil during a short but critical period of growth when seedlings were small in surface-drilled plots while in the paraquat-furrow-drilled treatments, soil moisture was only slightly lowered from field capacity. Otherwise, soil moisture was generally adequate for plant growth throughout the spring growing season. Rising air and soil temperatures were related to increased growth of weeds and wheatgrass seedlings. Soil temperatures were lower in furrows than under surface-drilled plots. (I) Reno, Nevada. III-331-D

Alfalfa Weevil and Cricket Chemical Control on Forage Crops. Nineteen insecticidal treatments were tested against the alfalfa weevil as spring sprays. One week after application carbaryl + R05-1557, carbaryl + R05-8019, GS-13005, H-14503, N-10242, and alfatox gave good control. Two weeks after application only N-10242 remained effective. Diazinon was applied for control of the striped ground cricket in black-belt pastures utilizing several diazinon formulations and various application techniques. Preliminary data indicate that all formulations and application techniques were statistically equal in cricket control. (E-fg) Alabama Agr. Exp. Sta. III-332-C

Forage Crop Pest Control. Evaluations were made on the effectiveness of chemicals applied with a low volume concentrate sprayer and the use of LP gas flaming in late fall and early spring treatments for control of the alfalfa weevil. LP gas flaming provides good control in early spring before most chemical sprays can be applied. Two new insecticides, Furadan (wett-able powder or granules) and American Cyanamid 47470 (emulsifiable concentrate) provided excellent control of the alfalfa weevil and look promising for future control programs. Laboratory screening tests were conducted to select candidate chemicals for future field (soil treatment) experiments. Fifty-six chemicals, formulated as granules, dusts and sprays, were tested. (E-fg) West Virginia Agr. Exp. Sta. III-332-C

Trifluralin Gave Good Weed Control in Alfalfa. Excellent grassy weed control in spring seeded alfalfa was achieved by preplant incorporation of 1 lb/A trifluralin, 2 and 4 lb/A EPTC, 1 and 2 lb/A benefin, and 1/2 and 1 lb/A SD 11831. When broadleaved weeds were present chemical control was possible with 2,4-DB. Chickweed, a serious winter annual, was controlled postemergence by 1/8 and 1/4 lb/A of paraquat, 1/8 and 1/4 lb/A diquat and 1 and 2 lb/A CIPC. CIPC formulations impregnated on fertilizer were equally effective as the liquid spray under greenhouse and field conditions. (E-fg) Maryland Agr. Exp. Sta. III-332-D

Nozzles Compared for Applying Ultra-low Volume Malathion for Grasshopper Control. Three spinner nozzles were compared by droplet size and efficiency of control on 160-acre rangeland plots. Technical malathion was applied at 6 fluid ounces per acre from a Cessna 337 plane. The Micronair spinner nozzles had the least portion of its volume in drops under 100 u in diameter and showed the greatest ground deposit as compared to the Fischer (EA-12) and turboero (Bals spinner) atomizers. (I) Bozeman, Montana. III-334-C

Chemicals Control Cottony Blight. In the Southern United States, cottony blight is the most severe disease on golf greens overseeded with annual ryegrass. Terrazole (5-etoxy-3-(trichloromethyl)-1,2,4-thiodiozole at 8 oz. (35% WP) per 1,000 sq. ft. gave satisfactory control without causing phytotoxicity. Varieties of creeping bentgrass differed in phytotoxicity reaction to the chemical. (I) Tifton, Georgia. III-335-B

Sod Webworm Attacking Buffalo Grass. The sod webworm attacking buffalo grass has been identified as Surattha indentella. There is one generation per year. It constructs a vertical tunnel 4-16 inches deep in the soil and a tube along the surface from opening of tunnel to a grass plant. Blades of grass are cut and pulled down into the tunnel at night and eaten during day. Duration of adult, egg, larval and pupal stages were determined. Sprays containing Dursban e.c. and SD 9098 were more effective than sprays containing Galecron or diazinon and granules with DiSyston, Temik or Ni 10242. (E-fg) Kansas Agr. Exp. Sta. III-335-C

Nematode Control in Turf. The sting nematode (Belonolaimus longicaudatus), the pseudo-root-knot nematode (Hypsoperine graminis), and the stubby-root nematode (Trichodorus christiei) cause great damage to turf grasses. In Georgia tests, several chemicals controlled these nematodes and restored turf to vigorous growth. Best overall performance was given by Nemagon, Zinophos, Thimet, Dasanit, and Mocap. Furadan and Temik gave fair nematode control but were less effective than the organophosphates as post-planting treatments on turf. (I) Tifton, Georgia. III-335-F

Control of Insects Affecting Soybeans. Soybeans protected continuously with DDT-Parathion yielded 38.4 bushels compared with 22.1 bushels in the untreated check. Excellent thrips control was obtained using several insecticides. Yield was not significantly different. Experimental ultra-low volume applicator showed promise in control of corn earworm and stink bugs. Heavy rates of disulfaton treated seed reduced soybean stands. Of 4 varieties treated with 4, 6 and 8 oz. per bushel of seed, Clark variety at the highest rate showed stand reductions of 76.9%. (E-fg) Missouri Agr. Exp. Sta. III-341-C

Phosphine Fumigation of Soybeans. Tests were conducted to determine the amount of phosphine residue on soybeans when fumigated with aluminum phosphide according to the Plant Pest Control Division's schedule of cereal leaf beetle control. In replicated fumigations at 45°, 55°, 65°, and 75° F., followed by 48 hours of aeration, the phosphine residues found on the soybeans were, in general, less than 0.001 p.p.m. However, a phosphine residue of 0.04 p.p.m. was found on one sample of the soybeans fumigated at 55° F. There was 100% mortality of caged black carpet beetle larvae and confused flour beetle adults exposed during each fumigation. (I) Savannah, Georgia. III-341-C

Atrazine Performed Better When Applied Preemergence Without Incorporation. Atrazine performed better when applied as a preemergence treatment with no incorporation than when applied as a preplant treatment with incorporation with a disk. Atrazine also performed better as a preemergence treatment than as a treatment applied well ahead of planting. Propachlor showed excellent weed grass control in both corn and soybeans without injury to either crop. (E-fg) Missouri Agr. Exp. Sta. III-341-D

Equipment and Procedures for Control of Weeds and Brush. Trifluralin performed best with the power rotary hoe. Gas chromatographic analysis of soil samples showed that the power rotary hoe concentrates the trifluralin in the upper one inch of soil while the disk harrow concentrates it at about two-thirds of its operating depth. A spraying system was adapted for applying herbicides at rates of from 0.2 to 5 gallons per acre. Satisfactory weed control was achieved although tests showed that less than 5% of the area was covered and up to 80% of the spray material was lost by drift and evaporation. Wire leaf lifters, a Larson Rig and an Oiling Rig were used with two chemicals for field studies on directed spraying in corn. Applications were made when the corn was 6 and 15 inches tall. Excellent weed control was achieved with both chemicals and all equipment but severe damage

resulted from applications to corn when it was 6 inches tall. (E-fg)
Missouri Agr. Exp. Sta.

III-341-D

Hazards to Soybeans from Herbicides Used in Other Crops. In Illinois, herbicides were incorporated in soil before planting and were applied postemergence to soybeans to evaluate the potential danger from soil residues or spray drift. Where herbicides were incorporated in the soil before planting, 8 oz/A of 2,4-D had little effect on soybean yields, but 4 oz/A of dicamba or 1/8 oz/A of picloram reduced soybean yields by 20 percent. Applications of 8 oz/A of 2,4-D, 4 oz/A of dicamba, or 2 oz/A of picloram in 1966 did not affect yield of soybeans planted 12 months later. Foliar application of 2,4-D, dicamba, or picloram to flowering soybeans reduced yields more than when the soybeans were treated before flowering. Significant reductions in yields were caused by rates as low as 2 oz/A of 2,4-D and 1/32 oz/A of either dicamba or picloram as postemergence treatments. (I) Urbana, Illinois.

III-341-D

Nature and Extent of Crop-Weed Competition Between Annual Weeds and Corn and Soybeans. The competitive effect of various weed infestations of Setaria lutescens, Polygonum pensylvanicum and Amaranthus retroflexus, with no control method imposed, yielded 1600 lb/A dry matter at maturity, and reduced soybean yields 6 bu/A. Single species infestations of each produced 500 to 900 lb/A dry matter and reduced soybean yields approximately 5 bu/A. Weed-free soybeans yielded 40 bu/A. When preemergence herbicides and rotary hoeing limited weed infestations to 200 lb/A dry matter or less, no appreciable soybean yield reductions were observed. (E-fg) Iowa Agr. Exp. Sta.

III-341-D

Preplant Incorporation of Certain Herbicides Improves Weed Control in Soybeans. Preplant soil incorporated applications of relatively more insoluble analogs of preemergence herbicides resulted in increased control of troublesome annual broadleaved weeds in soybeans, particularly under adverse conditions. More dependable and consistent chemical weed control in soybeans would permit utilization of narrow row culture to increase yields and profits. (E-fg) Indiana Agr. Exp. Sta.

III-341-D

Postemergence Herbicides for Soybeans. Postemergence applications of DNBP at 1 to 2 lb/A provided excellent control of weeds in soybeans in Mississippi. Addition of a surfactant greatly increased the toxicity of DNBP and increased yields of soybeans. Laterally directed postemergence applications of linuron continued promising for mid- to late-season control of sesbania in soybeans.

For the second successive year in Georgia, soybean yields on a Greenville sandy clay loam were increased following postemergence injection of the herbicide vernolate. The increase in yield is probably associated with the control of nutsedge. (I) Stoneville, Mississippi and Tifton, Georgia.

III-341-D

Weed Control Systems for Narrow Rowed Soybeans. In absence of weeds it is likely that soybeans in the Midwest could be grown in rows spaced 7 to 10 inches apart without postplanting cultivation. Experiments in Illinois and Minnesota indicate that incorporation of trifluralin in the soil before planting controls most weed grasses effectively in narrow-row soybeans, but does not provide adequate control of several species of broadleaf weeds. One of the most promising systems involved early preparation of seedbeds combined with incorporation of trifluralin in the soil and postemergence treatment of emerged broadleaf weeds with linuron before planting soybeans, or an application of chloroxuron applied to emerged broadleaf weeds after emergence of the crop. (I) Urbana, Illinois and St. Paul, Minnesota.

III-341-D

Weed Control with Incorporated Herbicides in Soybeans. Research in Illinois indicates that depth of incorporating trifluralin or vernolate in soil markedly influences effectiveness of controlling different weed species. Shallow incorporation (1/2 to 1 inch) of trifluralin or vernolate controlled giant foxtail and pigweed effectively. Control of annual morningglory with trifluralin or vernolate was poor with shallow incorporation, but improved as depth of incorporation was increased. Trifluralin controlled morningglory more effectively than vernolate, whereas, vernolate controlled velvetleaf more effectively. Best control was obtained at greatest depth of incorporation. Trifluralin did not injure soybeans at any depth of incorporation evaluated, while vernolate injured soybeans at all depth of incorporation. (I) Urbana, Illinois.

III-341-D

Control of Seedling Rust in Safflower. Plantvax, an oxathiin fungicide, has been found effective in greenhouse tests in the control of the seedling phase of safflower rust. Plantvax is a systemic fungicide that is readily absorbed by rootlets and taken into the plant where it induces resistance. (I) Logan, Utah.

III-343-B

Control of Weeds in Safflower. In Arizona, application of the herbicides diuron, prometryne, or linuron to the foliage of safflower caused stunting, stem bending, browning of leaves, delay of maturity, and reduction of yields. Non-directed applications of these herbicides do not appear safe for selective control of weeds in safflower. Directed postemergence application of trifluralin had no adverse effects and may be a useful treatment. (I) Phoenix, Arizona.

III-343-D

Botrytis Blight in Peanuts. Yield reductions do occur whenever Botrytis blight infections are severe. Test plots in Virginia showed that yields were increased 20% when a fungicide spray was used to control the disease. Application of the fungicides did not significantly affect the market grade components of the harvested peanuts. (I) Holland, Virginia.

III-344-B

Protectant for Farmers' Stock Peanuts. Bayer 77488 was the most outstanding of six compounds evaluated as a protectant for farmers' stock peanuts in small-bin tests.

Observations in farmers' stock peanut warehouses revealed that current recommendations for use of malathion as a protective treatment were still adequate for effective insect control when the insecticide was properly applied. The almond moth continued to be the most prevalent insect, but only two warehouses had populations high enough to damage the surface peanuts. (I) Tifton, Georgia.

III-344-C

Cottonseed Fumigation for Pink Bollworm. Field tests on stacks of sacked delinted cotton indicated that 180 tablets of aluminum phosphide per 1,000-cubic-feet killed 100% of pink bollworm larvae exposed for 120 hours. Preliminary data from later small-scale tests indicate this dosage might be reduced considerably. (I) Manhattan, Kansas.

III-345-C

Nematocide-Insecticide Mixtures in Cotton. Mixtures of the nematocide DBCP and the insecticide Di-syston also gave good nematode control and insect control in the Bakersfield area of California. Mixtures of SD-7727 and DD, and SD-7727 and DBCP, gave better root-knot control on cotton than either DBCP or DD alone, but no substantial yield increases were obtained from the combinations. The highest increased yield due to chemical control of root-knot nematodes was 0.5 bales of lint cotton per acre. Much higher yields have been observed in previous years when nematodes were controlled in the San Joaquin Valley. (I) Shafter, California.

III-351-A

Equipment for Incorporating Pesticides in the Soil. Further refinements were made on a fluorescent dye technique for evaluating soil incorporation equipment. Three different ground driven band incorporators mixed the dye in similar non-uniform patterns to a depth of 1.5 to 2 inches. Broadcast incorporators varied considerably, with the disc harrow incorporating to four inches. Better weed control was obtained by incorporating liquid formulations than with granular types. Cotton stand, plant height and yield were significantly reduced by deeper incorporation of trifluralin and nitralin. (I) Stoneville, Mississippi.

III-351-C

Biology and Control of Cotton Insects. In a test to control Heliothis zea on cotton treatments listed in decreasing order of effectiveness were toxaphene-DDT, methylparathion-Thiodan, Azodrin (1 qt.), Azodrin (1 pt.) and untreated check. A study of H. zea from 4 locations in Arizona in 1966 and 1967 indicated the existence of high levels of resistance to DDT. Treatments of Thimet, Di-syston and Temik applied to the soil at planting reduced thrips and aphid populations but these treatments had no influence on yield. Several insecticide combinations were evaluated for pink bollworm control. Guthion was the most effective treatment. (E-fg) Arizona Agr. Exp. Sta.

III-351-C

Control of Cotton Insects. Temik, a systemic insecticide applied at planting, gave excellent control of early season cotton pests such as thrips and aphids. Side-dress applications prior to plant fruiting resulted in control of the boll weevil, cotton aphid and cotton fleahopper for a period of 4 to 6 weeks. Temik was ineffective in controlling Heliothis spp. A study of the relative abundance of predators and parasites of Heliothis spp. revealed large numbers of these beneficial insects in cotton fields prior to insecticide application. In untreated fields beneficial insects were a major factor in the reduction in population numbers of Heliothis spp. (E-fg) North Carolina Agr. Exp. Sta.

III-351-C

Simulated Insect Damage to Cotton. Simulation of early-season cotton insect damage by manual removal of squares was the basis for an experiment to determine the necessity for protection of early-season cotton to produce high yields. The results indicated that, with adequate summer rainfall, the total loss of squares during the first 4 weeks of planting squaring caused a slowdown in crop maturity but not loss in yield. (E-fg) Alabama Agr. Exp. Sta.

III-351-C

Equipment for Ultra-Low-Volume Spraying of Cotton. A narrow spectrum drop-let generator was developed to evaluate 140,200 and 300 micron diameter droplets on insect control and spray deposit. No significant differences in control of boll weevil or oviposition punctures were found due to drop-let size. The controlled droplet size treatments did not achieve significantly different control from the standard ultra low volume applications. (I) State College, Mississippi.

III-351-C

Reproduction-diapause Boll Weevil Control Program Effective. In a survey in late August 1968 of cotton fields with a known boll weevil history in Presidio County, Texas, only one field was infested with boll weevils. Fields in the area had received 8 applications of organophosphorus insecticides in the fall of each of the 3 preceding years in a reproductive-diapause control program for the boll weevil. The infested field was one of the five fields that was infected in the area in 1967. (I) Tucson, Arizona.

III-351-C

Control of Weeds in Cotton. Preplanting applications of trifluralin or DCPA control annual grasses in California, but often do not control broad-leaf weeds satisfactorily. The effectiveness of broadleaf weed control can be increased by applying diuron, linuron, prometryne, or fluometuron to the soil surface immediately before planting without adverse effects on the cotton yield. The planning procedure removes the surface soil which contains the second herbicide from the seedbeds. Subsequent cultivation move the herbicide-treated soil back into the cotton bed before the first postplanting irrigation (after emergence of the crop). (I) Shafter, California.

III-351-D

New Herbicides for Cotton. In Mississippi, 2-chloro-2',6'-diethyl-N-(methoxymethyl) acetanilide (CP-50144) appeared to have considerable potential for control of weeds in cotton. Liquid formulations of several herbicides controlled weeds better than identical rates of granular formulations under 1967 conditions. (I) Stoneville, Mississippi. III-351-D

Pesticide Interactions in Cotton. In Arizona, incorporation of trifluralin in soil before planting cotton decreased injury to the cotton by a second herbicide diuron, also incorporated before planting. Apparently the effect was due to inhibition of secondary roots by trifluralin which in turn reduced the absorption of diuron by the young seedlings. Incorporation of the systemic insecticides, phorate or disulfoton, largely offset the inhibitory effect of trifluralin or nitralin on secondary roots. Phorate and disulfoton also offset the inhibitory effect of nitralin on tap-root development of cotton seedlings. (I) Phoenix, Arizona. III-351-D

Precision Incorporation of Herbicides in Cotton. Nitralin appears to retard root development more than trifluralin. Research in California indicates that depths of incorporation and placement of cotton seed in relation to the depth of herbicide incorporation is important in determining the response of cotton to the herbicide. Simultaneous incorporation of herbicides in moist soil and planting of the crop would permit a substantial lowering of the rate of trifluralin or nitralin without loss of weed control. Reduction in rate and gain in precision of herbicide and seed placement, through doing the operations simultaneously, decreases the likelihood of injury to cotton and reduces the hazards of soil residues and cost of herbicide treatments. (I) Shafter, California. III-351-D

Research to Increase Safety and Effectiveness of Herbicides in Cotton. Multiple herbicide treatments are now widely used in cotton production. Results at Stoneville, Mississippi, indicate that the use of too many herbicide treatments may reduce cotton yields without significantly improving weed control.

Stunting of cotton, some loss of stands, and extremely variable growth rates were noted in fields treated with the herbicides nitralin and trifluralin. Analyses of soil samples collected in July 1967 from fields of injured cotton indicated the presence of herbicides at as much as three times the recommended rate and to depths up to 6 inches. Previous investigations have indicated inconclusively that cotton tolerance to the chemical is in part dependent on the depth of incorporation. (I) Stoneville, Mississippi. III-351-D

Nematode Control in Cotton on the Mississippi Delta. Soil applications of the nematocide DBCP and the insecticide-nematocides Temik, Mocap, and Dasanit, gave outstanding control of reniform and root-knot nematodes on cotton in Louisiana. Yield increases up to 700 pounds per acre of seed cotton were obtained. The new root-knot resistant variety Bayou responded favorable to nematocide applications on soil infested with the reniform nematode. On

root-knot-infested soil, Bayou yielded somewhat better than Deltapine smooth-leaf when root-knot nematodes were controlled with nematocides. But use of nematocides in addition to a root-knot resistant variety did not appear profitable. (I) Baton Rouge, Louisiana. III-351-F

Root-Knot Control in Irrigated Cotton. In Arizona, the rate of kill of root-knot nematodes by DBCP in irrigation water on cotton was 85, 97, and 99 percent after 10, 20 and 60 days respectively. A mixture of SD-7727 and DBCP gave better root-knot control, which persisted longer during the growing season than either chemical alone. This was because DBCP has high volatility and gave quick kill, while the SD-7727 provides long lasting seasonal control. In several field tests on the High Plains of Texas, root-knot control with nematocides gave up to 200 pounds increase in yield of lint cotton. Di-syston, Dasanit, and a mixture of SD-7727 and DBCP, gave superior nematode control and yield equal to, or better than, standard applications of chlorinated hydrocarbons such as DD and DBCP. The organophosphate nematocides also gave good control of thrips. (I) Phoenix, Arizona and Lubbock, Texas.

III-351-F

Quick-wilt Harvesting Technique. A new method of preparing cotton for mechanical harvesting is under investigation. Chemicals have been found which will induce wilting of all leaves in a field within 3 to 12 hours. It has been shown that cotton may be harvested satisfactorily when flaccid leaves are still attached to the plant without reductions in quality or machine efficiency. If this technique proves successful an additional 7 to 10 days maturation period will be obtained, thus tending to improve quality and yield of cotton obtained in second picking operation. (I) Stoneville, Mississippi; Shafter, California.

III-351-G

Ultra-low Volume Application of Defoliants. Experimental applications of full strength defoliant formulations in the range of 2-4 pints per acre appear to be yielding satisfactory results. The development of this method, if continued testing proves satisfactory, will greatly decrease handling time and labor involved in ground machine and air defoliant applications. (I) Stoneville, Mississippi; Shafter, California.

III-351-G

Atmospheric Fumigation of Tobacco. At atmospheric pressure, 30 ppm of phosphine in air killed all stages of the cigarette beetle in tobacco hogsheads. Phosphine concentrations inside the hogshhead and surrounding air-space were similar. The dosage used was 12 aluminum phosphide pellets/1,000 cu. ft. for 96 hours at 80° F. and 60% R. H. At 3- and 6-pellet dosages, some 4th-instar larvae, pupae, and adults survived. (I) Richmond, Virginia

III-36-C

Vacuum Fumigation of Tobacco. In vacuum fumigation, acrylonitrile at 4, 6 and 8 lb/1,000 cu. ft. killed cigarette beetle larvae at depths of 5, 7, and 9 inches, respectively, inside compressed tobacco. HCN, at 4 lb., killed larvae at all depths in cases. Acrylonitrile aerated from the tobacco rapidly, whereas HCN aerated slowly. (I) Richmond, Virginia.

III-36-C

Insecticide Evaluation for Cigarette Beetle. Of insecticides evaluated against the adult cigarette beetle, only Accothion and Dursban were effective both as a residual and vapor toxicant. (I) Richmond, Virginia.

III-36-C

Low Residue Insecticide Mixture Shows Promise on Tobacco Insects. Pilot tests indicated good control of tobacco hornworm, tobacco flea beetle, and green peach aphid with dust or spray applications of a combination insecticide mixture of Mobam, rotenone, and parathion which leaves little residue on the treated plants. (I) Florence, South Carolina.

III-36-C

On Shade Grown Tobacco an Integrated Control Gives Equal Protection at Less Cost. For three growing seasons an integrated insect control program was conducted using disulfoton, light traps, the pathogen *Bacillus thuringiensis* and nonpersistent insecticide treatments as needed. Compared to conventional programs the integrated programs reduced the total number of seasonal insecticide applications on cigar wrapper tobacco in 1965, 1966, and 1967 by 80, 76, and 43 percent respectively, in addition to providing comparable protection against plant damage. In 1967 cooperators grew 71 acres of tobacco under the integrated program and showed a saving of approximately \$26 per acre compared with the regular insecticide program. (I) Quincy, Florida.

III-36-C

Control of Weeds in Tobacco. In evaluating pyriclor for control of witchweed in North Carolina, it was discovered that the material would selectively remove crabgrass and pigweed from tobacco transplants with a high degree of tolerance by the crop. Pyriclor controls weeds at rates of 3 to 9 oz/A.

Subsurface applications of pebulate continue promising for control of weeds in tobacco in Georgia. Leafmen's evaluation indicated a preference for tobacco given subsurface applications of pebulate as compared with cultivated tobacco or tobacco where pebulate had been incorporated in the soil. (I) Whiteville, North Carolina and Tifton, Georgia.

III-36-D

Nematode Control in Tobacco. Twelve nematocidal compounds were evaluated for root-knot control and/or promotion of tobacco growth in Georgia. The performance of these compounds was compared with a standard treatment of DD. The compounds that equal or surpass DD in performance were Temik, Mocap, Penphene, and SD-14647. Disk-harrow incorporation of Temik was as effective as rototilling. Disk-harrow incorporation of Mocap was superior to rototilling. The best treatment, Temik, increased tobacco yield 491 lbs. per acre. (I) Tifton, Georgia.

III-36-F

New Nematicides Effective in Control of Tobacco Nematodes. Two new nematicides have been registered for use on tobacco: Dasanit and Mocap. At approved dosages, treatment with these materials have given crop responses comparable to that obtained with standard fumigants but the degree of nematode control has been somewhat variable in studies conducted in North Carolina. (E-fg) North Carolina Agr. Exp. Sta.

III-36-F

Improved Analytical Techniques. Various extraction methods were evaluated for the analysis of DDT analogs in alfalfa hay containing low levels of pesticides. Of 4 procedures and 6 solvent mixtures tested, the best results were obtained from extraction with chloroform:methanol (1:1) in a high-speed mixer for 10 minutes. The extracted materials were analyzed using gas chromatography with electron-capture detection. Less effective methods of extraction included Soxhlet treatment for 16 hours and mechanical shaking for 16 hours. Solvent costs, ease of handling, convenience of equipment cleaning, and total elapsed time of analysis were factors considered in the method development. (E-fg) Arizona Agr. Exp. Sta. III-37-A

Control of Weeds in Sugarcane. Neither fenac, terbacil, nor picloram reduced the yield of sugarcane in Louisiana when the herbicides were applied in three successive applications over a 2-year period. Varieties of sugarcane exhibited a differential tolerance to multiple applications of either fenac or terbacil. (I) Houma, Louisiana. III-371-D

Johnsongrass in Sugarcane. Two applications of MSMA to the foliage of established johnsongrass was more effective than two applications of dalapon. More rhizomes were killed with MSMA than with dalapon. This suggests that the organic arsenical herbicides can be translocated to underground organs of treated weeds. Sugarcane was moderately injured by two applications of MSMA, but the yield was equivalent to that of sugarcane receiving a standard herbicide treatment. Trifluralin controlled johnsongrass seedlings effectively without injury to sugarcane. Also, trifluralin was one of only two herbicides that controlled Raoul grass effectively. It did not control broadleaf weeds, and a split application involving fall and early spring treatments was no more effective in control of johnsongrass than a single application made in the spring only. Yield of sugarcane was not affected by rates as high as 3 lb/A. (I) Houma, Louisiana. III-371-D

Control of Weeds in Sugarbeets. In Colorado about 80 percent of a mixed population of foxtail, lambsquarters, and pigweeds can be controlled with currently registered herbicides applied before planting. About 90 to 95 percent of these three weeds can be controlled with a postemergence mixture of pyrazon plus dalapon used in combination with a preplanting treatment. These treatments, however, do not adequately control kochia. A new herbicide, benzadox, controls up to 80 percent of the kochia when applied as a early-season postemergence treatment. An application for registration and a petition for a finite tolerance for benzadox have been made. (I) Fort Collins, Colorado. III-372-D

Herbicides for Sugarbeets in Washington. The best selective weed control in sugarbeets with the herbicide cycloate in Washington resulted from thorough incorporation to depths of 3 inches. Placement of the herbicide in a layer 2 inches beneath the surface increased the herbicidal activity on both weeds and sugarbeets. Injection of the herbicide in two lines on each side of the drillrow provided only slightly less effective control than thorough

incorporation and reduced loss of moisture from the seedbed which often occurs from thorough incorporation.

The herbicide pyrazon and propachlor do not appear safe for control of weeds in sugar beets under Washington conditions. (I) Prosser, Washington.

III-372-D

Herbicide Interactions in Sugar Beet Weed Control. Preplanting treatment with cycloate increased susceptibility of sugar beets to postemergence application of a mixture of pyrazon plus dalapon. Likewise, an application of cycloate before planting sugar beets increased the susceptibility of kochia to postemergence application of benzadox. Response of sugar beets to the treatment appeared temporary and yields were not reduced. (I) Fort Collins, Colorado.

III-372-D

Weed Control in Sugar Beets. In the heavy rains of 1967, CP-52223 was the best pre-emergence herbicide in sugar beets. Pyrazon plus TCA continued to be better than other label approved herbicides tested. ACP glomules (pyrazon plus other herbicides) seem worthy of further trials. Pre-emergence herbicides giving good annual weed control and top yields in white potatoes in 1967 were: linuron, patoran, C-6313, and paraquat. (E-fg) Maine Agr. Exp. Sta.

III-372-D

Control of Sugar Beet Nematode Diseases. Sugar beet nematode damage has been observed in increasing instances in a few areas where preplant herbicides (Tillam, Tillam combinations and Pyramin) are being used. Losses due to nematodes were very severe in 1967 in eastern Colorado. Losses range up to 50% of crop yield on certain farms. Data in which test strips on at least 12 farms were commercially fumigated shows 50-100% yield increases using Telone or DD. During the summer side dress treatments of dibromochloropropane (DBCP-Fumazone or Nemagon) were applied. These indicated that there is no damage when the material is applied postplant. (E-fg) Colorado Agr. Exp. Sta.

III-372-F

Control of Weeds in Grass Seed Crops. Split applications of diuron in October and February controlled all of the annual bluegrass in Kentucky bluegrass seed fields without adversely affecting the seed-yield.

One lb/A of terbacil controlled downy brome and increased the seed yield of creeping red fescue and Kentucky bluegrass in central and eastern Oregon. (I) Corvallis, Oregon.

III-38-D

Control of Weeds in Legume Seed Crops. Amine or ester formulations of 2,4-DB (0.5 to 1.5 lb/A) reduced the yield of seed from Louisiana S-1 white clover when applied at any of three different stages of growth.

Paraquat and diquat controlled winter annual broadleaf and grass weeds in fields of perennial clover being grown for seed without injuring the clover. (I) Corvallis, Oregon.

III-38-D

Dodder Control in Alfalfa. In Washington, dodder seedlings were controlled effectively by vapors of CIPC or dichlobenil from the surface of the soil. This finding helps to explain why incorporation of CIPC does not increase its effectiveness for control of dodder. (I) Prosser, Washington

III-38-D

Horticultural Crops

Control of Coffee Insect Pests. Leaf miner infestations in the order of 35% of the leaves affected reduced coffee yields by 50% in the first crop. A dust mixture containing 1.5% Parathion and 3.5% Dieldrin applied at the rate of 20 lbs. per acre affords effective control of practically all the coffee pests when applied as a preventative measure or when an application of the 10% formulation of the systemic insecticide Disyston applied to the soil around growing coffee trees during wet periods as early as the seedling stage and as late as 90 days before harvest of yielding trees prevents leaf miner attack for as long as 5 months. (E-fg) Puerto Rico Agr. Exp. Sta.

III-41-C

Control of Vegetable and Orchard Insects. An atomizing nozzle modified to increase the energy of the air jets was used to apply Cygon 2E and Guthion ULV each at 8 oz. avdp. per acre, Malathion Tech ULV at 24 oz. avdp. per acre, and Meta-Systox-R ULV at 6 oz. avdp. per acre to plots of cabbage, cucumbers, eggplant, lima beans, peppers, tomatoes and turnips. The same insecticides in emulsifiable form were applied in water spray at 150 gallons per acre to similar plots on the same time schedule. Metz-Systox-R applied by either method controlled aphids and two-spotted spider mite. All other treatments gave inferior control. Laboratory studies of physical properties versus temperature showed flow rate of some ULV insecticides can vary 5 to 19 percent with 5° F. change in temperature. Wettable powders added to spray formulation at 66 times normal concentration increased volume 10 percent. Violent hydraulic agitation increased some temperatures 10° F. and volume 25 percent in five minutes. Normal, 33X and 66X sprays applied to randomized plots of Red Rome Beauty and Cortland apple trees averaging 17 feet in height gave satisfactory control of scab and insect pests. (I) Wooster, Ohio.

III-41-C

Temperature Influence on Residues. Residues on raisins dried on malathion-treated trays were influenced by maturity of grapes and temperature. More mature grapes had lower residues and raisins that had dried during warmer weather had higher residues. (I) Fresno, California.

III-41-C

Deciduous and Small Fruits and Tree Nuts. A seven-year study of the effects of repeated annual applications of several herbicides in blueberry plantings showed that growth, yield, and quality of the crop were not reduced by

simazine or diuron. Herbicidal effectiveness of diuron treatment increased as treatments were continued, whereas, effectiveness of simazine decreased. Simazine-tolerant weed strains were evident. Control of weeds in peaches conducted over a seven-year period revealed that this crop is a poor competitor with weeds, even low growing grasses. Simazine used repeatedly did not reduce growth rate, yield, or quality of the crop. Simazine-tolerant weed strains developed. Dichlobenil controls bracken fern in cranberries without reducing growth, yield, or quality of the crop. (I) New Brunswick, New Jersey.

III-41-D

Herbicide Cloth. A new method of applying herbicides impregnated in cloth is proving effective as a means of improving accuracy and convenience in the use of herbicides in ornamental plantings and in home-garden vegetable plantings. (I) Beltsville, Maryland.

III-41-D

2,4-D Air Pollution Affects Trees. 2,4-D air pollution affects trees exposed to repeated sublethal dosages in the same general pattern as to herbaceous plants like zinnias. At levels averaging a little lower than 1 ppb. shoot elongation may be stimulated while at higher levels shoots are stunted but more are stimulated to grow. At appreciably higher levels all new growth is retarded markedly and still higher but considerably under levels resulting in death of the tree foliage present becomes brittle and develops dead burned edges (as though affected by acute foliar disease, low smog levels, salt injury - premature senescence). (E-fg) Iowa Agr. Exp. Sta.

III-41-D

Incorporation of Herbicides in Furrow Irrigated Soils. In furrow-irrigation, several herbicide families controlled weeds most efficiently when incorporated uniformly into soil; soil surface-applied herbicides required rain for activation and could be moved by high winds. The most efficient depth of mechanical soil incorporation depended on characteristics of the specific herbicide and climatic conditions after treatment. Deeper incorporation required more selective herbicides or delayed vegetable plantings for selectivity. Increased rates of herbicidal application and depth of incorporation resulted in longer persistence in soil. Volatile carbamates often persisted only one month, whereas, less volatile compounds persisted five to eleven months in field soils. Soil-incorporated carbamate herbicides were generally deactivated in the greatest depth of incorporation and persisted the longest near the surface of furrow-irrigated soils. (I) Weslaco, Texas.

III-41-D

Weed Control in Irrigated Vegetables. Several soil-persistent herbicides were sufficiently selective with soil incorporation in plantings of certain vegetables, namely: trifluralin in carrots and cabbage; N-isopropyl-2-chloroacetanilide (CP-31393) in onions; bensulide in cantaloupes, watermelon, cabbage, carrots, lettuce, and tomatoes; and benefin in lettuce. (I) Weslaco, Texas.

III-41-D

Weed Control in Peas and Leafy Vegetables. Subsurface chisel placement of vernolate in the soil controlled more than 90 percent of the nutsedge present in plantings of southern peas. Vernolate applied after peas reached the 4 to 6 leaf stage did not reduce yield or quality of the crop. Treatments applied at earlier growth stages caused severe injury. Among several herbicides studied for use in mustard and turnip green plantings, DCPA and trifluralin were most effective and best tolerated by the crops. Because of its persistence in the soil, trifluralin presents a problem in rotation practices. (I) Tifton, Georgia. III-41-D

Nematode and Other Pest Control in Southern Vegetables. Mocap gave best root-knot control of several nematocides tested. The wide-range soil fumigants, Vorlex, Darco, and MTBG gave measurable weed control. All treatments involving the herbicide pebulate, and MTBG, gave excellent weed control. Tomato transplant growth was best when good weed and nematode control was obtained and results did not indicate that soil fungicides were necessary. Organophosphate nematocides gave good control of root-knot nematodes on Yellow Crookneck squash, Emerald okra, Thaxter bean, and Cream-40 cowpeas. Yield increases were comparable to those obtained with proprietary soil fumigants, such as EDB. When root-knot was controlled, yields increased as follows: squash, more than 5-tons per acre; okra, 12-tons per acre; lima beans, 3-tons per acre; and southern peas, 1.2-tons per acre. (I) Tifton, Georgia. III-42-A

Cue-lure Bait Stations Remain Fully Attractive to Melon Fly Males for More Than Four Months Despite 16" Rainfall. Canefiber board stations (2" x 2" by 1/2") saturated with cue-lure and naled 20:1 at the rate of 25 gm per station, were distributed in a 2-mile² area at four per acre. Samples withdrawn after four months exposure and compared by bioassay with freshly saturated stations were found equally effective. In the treated area melon fly male catches in traps were 95-99 percent below those of untreated areas and more than 99 percent below the pretreatment level. (I) Honolulu, Hawaii. III-42-C

Vegetable Insect Control With Insecticides and Resistant Plant Varieties. Diazinon applied over sweet potato foliage when roots began to form gave complete control of wireworms. Control extended beyond the treated area. Only traces of sweet potato flea beetle injury appeared in the treated area. Antibiosis of crucifers to newly hatched diamondback caterpillars correlated with leaf cell compactness. Resistance of sweet corn to sap beetles and corn earworm correlated with tightness of the husk, length of the silk channel, and silk antibiosis. Sweet corn insects were more attracted to colors at the short wave end. Replicated plantings of 100 cruciferous varieties showed wide differences in damage by spotted cucumber beetles, also some varieties were heavily damaged by Mexican bean beetles and cabbage caterpillars. (E-fg) North Carolina Agr. Exp. Sta. III-42-C

Equipment for Dusting Vegetable Crops. Mixed dusts bridged in the hopper of a trailing boom duster, though unmixed dusts flowed readily. Gate agitation and compressed air fluidizing was not effective. A vertical rotating shaft with stiff wire spines inserted was mounted on the hopper lid, projecting downward to the throat of the hopper, to break up the lodged dust.

(I) Forest Grove, Oregon.

III-42-C

Potatoes. The levels of 17 nutrient elements in the leaves of potatoes were unaffected by herbicidally effective treatments of EPTC or DNBP applied before emergence of the crop. (E) Wooster, Ohio.

III-421-D

Control of Nematodes of Sweet Potatoes. In Louisiana, control of reniform nematode and highest yields and best grades of sweet potatoes were realized from soil treatments with Temik, Dasanit, and Mocap. These chemicals perform better than chlorinated hydrocarbons such as DD. The best treatment, Temik, increased yields of US No. 1 sweet potatoes by 133 bushels per acre. (I) Baton Rouge, Louisiana.

III-421-F

Tomato Quality. The quality of raw tomatoes was unaffected by herbicidally effective treatments of diphenamid, amiben, or DCPA. Maturation of tomato fruits was hastened by herbicide treatment. The composition of the processed product was unaffected by herbicide treatments. (E) Wooster, Ohio.

III-422-D

Soil Treatments for Root-knot. In Georgia, a mixture of specific biocides (nematocides, herbicides, and fungicides) were compared with wide-range soil fumigants for control of nematodes, weeds, and soil fungi. Both specific nematocides and wide-range soil fumigants gave significant control of root-knot, but this control was not adequate for tomato transplant production.

(I) Tifton, Georgia.

III-422-F

Fungicides Fail to Control Navy Bean Root Rot. PCNB, Super X, Lanstan, and Demosan were applied, at several rates, to naturally infested soil just prior to planting with the navy bean variety Seaway. Seedlings were pulled at blossoming and indexed for root rot damage. None of the compounds tested reduced the amount of root rot significantly. (I) East Lansing, Michigan.

III-424-B

Fungicidal Control of White Mold in Navy Beans. Three fungicides, PCNB, dichloran, and ferbam, were applied to navy beans as foliar sprays for evaluation of their effectiveness in controlling white mold disease. All treatments effectively reduced white mold and increased yield. PCNB and dichloran were more effective than ferbam. Dichloran caused damage to plants after the second application. (I) East Lansing, Michigan. III-424-B

New Materials Control Root Rots of Leguminous Plants. The systemic fungicide Plantvax, and U. S. Rubber F 249, reduced *Rhizoctonia* root rot of snapbean by 50 and 75%, respectively, over untreated controls in Delaware. In addition, F 849 treatment gave the greatest number of healthy plants over four other materials tested (Vitavax, Plantvax, Demosan and duPont 1991). (E-fg) Delaware Agr. Exp. Sta. III-424-B

Population Dynamics of Arthropods on Lima and Soybeans. Arthropod populations of lima beans and soybeans growing alone or adjacent to each other showed that lima beans are more attractive to potato leafhoppers than soybeans under either growing condition and were equally attractive to green cloverworm. Lima beans harbor more arthropods, both pest and beneficial, than soybeans both in numbers and variety. The use of systemic insecticides decreases the total numbers of arthropods found on lima beans but greatly increases the proportion of beneficial species in the population. (E-fg) Delaware Agr. Exp. Sta. III-424-C

Pesticide-Parasite Combination Gives Best Control of Pea Aphid. Soil applications of UC-21149 to alfalfa, the overwintering host of the pea aphid, suppressed aphid populations through three plant growth cycles in the presence of the braconid parasite, *Aphidius smithii*, in eastern Washington. UC-21149 nor parasites alone was as effective as the combination for aphid control. (I) Yakima, Washington. III-425-C

Wilt and Candelilla Diseases of Edible Yams (*Dioscorea* SPP.) *Gloeosporium* was consistently isolated from leaves and vines of Florida yam, *Dioscorea alata*, affected by "candelilla". Inoculations of plants of this species with isolates of the fungus failed to produce the disease. An early and serious outbreak of "candelilla" on Florida yam in the Luguillo area prompted the establishment of a fungicide spray trial. Plots were set aside in a corner of an affected field and sprayed separately with captan, Dithane M-45, and an experimental systemic fungicide. (E-fg) Puerto Rico Agr. Exp. Sta. III-426-B

Insect Control at the Soil-Contact Surface of Watermelon and Cantaloupe. The striped cucumber beetle larva, wireworms and the spotted cucumber beetle larva were found responsible for injury to the soil-contact surface of watermelon and cantaloupe. Pre-planting application of either Bayer 37289 or Dasanit, at 4 lbs. per acre, effectively controlled injury to watermelon and cantaloupe fruit at the soil-contact surface. Placing a sheet of "Lumite" horticultural screen under each melon early in its development also prevented such injury. (E-fg) Delaware Agr. Exp. Sta. III-428-C

Dichlorvos on Corn Cobs Effective on Greenhouse Whitefly. Populations of whiteflies on greenhouse tomatoes were destroyed by continuous exposure to corn cobs impregnated with dichlorvos. Freshly impregnated corn cobs were more active than commercially available resin strips and tests indicated that their insecticidal toxicity lasted at least 6 years. Other treatments giving control were aerosol treatments of tepp, sulfo-tepp, dichlorvos, and parathion applied 6 times at 4-day intervals. (I) Beltsville, Maryland, III-429-C

Use of Atrazine in Sweet Corn. Surface, preemergence applications of atrazine prevented fibrous brace root formation in sweet corn and reduced yields about 30 percent. Cultivation of soil over the brace root area during early vegetative growth prevented this effect. (I) Beltsville, Maryland.

III-429-D

Sinbar Gave Excellent Weed Control in Fruit Crops. Four long-lasting herbicides were compared for efficacy in controlling weeds in orchards throughout the entire growing season. "Sinbar" terbacil was found to be far more effective than the others at rates which were tolerated by apple trees in their first leaf. Sinbar gave a mean of 97% control on September 11, compared to 86% for "Karmex" diuron, 83% for "Casoron" dichlobenil, and 70% for Simazine. All herbicides were supplemented as was feasible with Paraquat, a "chemical mowing" agent. Importance of organic matter in reducing phytotoxicity of the substituted uracils to peach and apple trees was studied further, without major new findings. (E-fg) Delaware Agr. Exp. Sta.

III-43-D

Lesser Peach Tree Borer Ovicide Tests. Eggs of the insect were exposed to nine pesticides in laboratory tests to measure ovicidal activity. Superior oil, parathion, and endosulfan showed high ovitoxicity; dimethoate, and azinphosmethyl were of moderate toxicity; and binapacryl, dicofol, and tetradifon were low in toxicity. (I) Vincennes, Indiana.

III-431-C

Weed Control in Peach Trees. Results obtained indicated that the tolerance of peach trees to dichlobenil, simazine, trifluralin, terbacil and DP 733 is primarily positional; i.e., the location of the herbicides in relation to the root zone of the peach trees is critical. (E-fg) North Carolina Agr. Exp. Sta.

III-431-D

Nematodes of Peaches. In Georgia 3 species of root-lesion nematodes (Pratylenchus vulnus, P. brachyurus, and P. zeae) occurred in large numbers but in varying populations. Studies of individual trees revealed that tree decline was associated with frequency of occurrence of P. vulnus. The other species, though frequently found in peach orchards, were not contributing significantly to short life. Several new nematocides control both root-knot and lesion nematodes on peaches, and thereby allow vigorous growth of first and second-year seedlings. (I) Fort Valley, Georgia.

III-431-F

Extended Usage of Antibiotic for Control of Fire Blight on Apples. Heretofore the use of streptomycin on apples for fire blight control has been limited to blossom sprays. Because much infection starts in the post-bloom period such a restricted spray schedule makes it commercially impossible to raise susceptible apple varieties. Based on work conducted at Beltsville, FDA approved streptomycin (50 ppm) for use during cover spray applications providing the antibiotic is not sprayed within 50 days of harvest. With this extended use we can now expect farmers to increase production of desirable apple varieties such as Jonathan. (I) Beltsville, Maryland.

III-433-B

Meeting EEC Tolerances for Biphenyl in Citrus Fruits. As of July 1, 1968, the tolerance for biphenyl in citrus fruits sold in EEC countries was reduced to 70 ppm. This compares with a U. S. tolerance of 110 ppm. A series of experiments were conducted during the past early summer to determine biphenyl residues in oranges at arrival and during distribution in European markets. Such factors as precooling, transit temperature, load pattern, and time in transit were related to biphenyl residues in an attempt to recommend handling practices which would assure acceptable residues. Both decay and biphenyl residues were reduced by continuous refrigeration and this now appears to be the only acceptable procedure.

Experiments in the laboratory have reconfirmed that reducing the amount or changing placement of biphenyl in the orange container do not solve the residue problem. The purpose of the biphenyl is decay control and amount and placement are critical for attaining this. (I) Pomona, California.

III-44-B

New Extender for Fruit Fly Lures Found. Thixcin E was superior to Cab-O-Sil as a convenient stir-in type of thixotrope for preparing viscous lure plus toxicant formulations useful in fruit fly male-annihilation programs. The shearing action of a blender is sufficient to disperse the Thixcin E in fruit fly lures to produce mixtures of the proper consistency without the use of heat. (I) Honolulu, Hawaii.

III-44-C

Improvement of Spray Penetration in Citrus Trees. Swirling jet or vortex airstream sprayers require no more energy than a flat airstream sprayer for the same mean spray penetration into a tree. Significant differences were found in the volume of spray in some parts of trees. Tests with airblast sprayers showed that spray droplet size had a highly significant influence on penetration into the tree. Nominal droplet size of 275 micron diameter gave best distribution with either swirl jet or flat airstream nozzle. (PL-480). Volcani Institute of Agricultural Research, Rehovot, Israel.

III-44-C

Citrus Nematode in Arizona. In Arizona, a 9-year study of citrus nematode control with DBCP in irrigation water, shows that citrus groves treated with 2-gallons per acre of DBCP allows new normal citrus growth and gives good nematode control for 2 years, with accompanying high yield increases. After 2 years, retreatment is necessary, but the cost is nominal. (I) Phoenix, Arizona.

III-44-F

New Methods for Controlling Citrus Nematode in Florida. Control of the citrus nematode on bearing trees with the nematocide DBCP has resulted in substantial yield increases for the first time in Florida. Applications of emulsifiable DBCP through sprinkler irrigation has been improved, and a water pressure-injection system for applying nematocides to established trees has been developed. Also, bareroot dips of nursery stock with

organophosphate nematocides has given practical control of burrowing and citrus-root nematodes. No chemical phytotoxicity was evident. Bare-root dips have recently been incorporated into regulatory programs to rid nursery rootstock of plant-parasitic nematodes. (I) Orlando, Florida.

III-44-F

Systemics Effective Against Citrus Red Mites. A soil surface application of 0.4 g. phorate to 1 gallon pots containing seedling oranges resulted in an 88 percent mortality of citrus red mite 45 weeks after treatment. Disulfoton at the same dosage is still giving 85 percent mortality after 52 weeks.

(I) Riverside, California.

III-441-C

New Fungicides for Improved Control of Cranberry Foliage and Fruit Diseases. Isolation of fungi from cranberry stems, leaves, flowers and fruits indicated that two fungi causing important fruit rots in Wisconsin were also colonizing the stems. Two other fungi reputedly causing important fruit rot were commonly found on fruits and leaves but appeared to cause no serious damage. Two newer fungicides were found to give better control of fruit rots than fungicides currently recommended. A dieback of uprights was found to be associated with unseasonable temperatures and humidity and an infection of stems by a fungus. Additional infestations of marshes by a virus-like ringspot disease were found. (E-fg) Wisconsin Agr. Exp. Sta.

III-453-B

Ornamentals. Yews and Japanese maple seedlings were found tolerant to four annual applications of CIPC, DNBP, DCPA, and trifluralin used at twice the usual weedkilling dosage. Combinations of two of these herbicides at less than the usual individual dosages may prove practical for broad spectrum weed control in these crops. Three carbamate herbicides, four symmetrical triazines, and dichlobenil are proving effective as soil treatments to control mugwort (Artemisia vulgaris L.). (I) Beltsville, Maryland

III-46-D

Nematicides in Control of Rose Nematodes. Three of the most promising non-phytotoxic nematicides and a mulching material that in 1966 was found to be frequently associated with low plant parasitic nematode populations in established rose gardens were tested for nematode control in ten home rose gardens. A total of 160 rose bushes were treated and all of the materials reduced the size of the plant parasitic nematode populations to 28-86% of the controls. Only two of the materials, Nemagon (DBCP) at 4 gallons/acre active and Temik (10% granular) at 100 pounds/acre, used at the highest recommended rates gave fairly satisfactory control by reducing the size of plant parasitic nematode populations present at the end of the growing season to 28 and 35% of the control, respectively. (E-fg) Minnesota Agr. Exp. Sta.

III-461-B

Tulip Bulb Aphid Controlled on Iris Rhizomes During Storage. Complete kill of tulip bulb aphids on stored iris rhizomes was obtained in 1 week in a growth retarding chamber when resin strips 10 x 2½" containing 20% dichlorvos were distributed at the rate of 1 or 2 per thousand feet³. (I) Sumner, Washington.

III-461-C

The Search for Improved Nematicides for Ornamentals Continues. In Minnesota three of the most promising non-phytotoxic nematicides and a mulching material that in 1966 was found to be frequently associated with low plant parasitic nematode populations in established rose gardens were tested for nematode control in ten home rose gardens. A total of 160 rose bushes were treated and all of the materials reduced the size of plant parasitic nematode populations. (E-fg) Minnesota Agr. Exp. Sta.

III-461-F

Control of Azalea Leaf Miner. Observations were made on the life history and habits of the azalea leaf miner, Gracillaria azalee Brants, infesting azaleas. A wasp was found parasitizing the insect. Dimethoate was effective in suppressing the infestations. (E-fg) Alabama Agr. Exp. Sta.

III-462-C

Root-knot Control in Ornamentals. Excellent control of root-knot nematodes was obtained on Dwarf Japanese holly and Japanese boxwood with Dasanit and Mocap as drenches. These chemicals gave almost complete control of root-knot nematodes in Georgia. (I) Tifton, Georgia.

III-462-F

Nematode Control in House Plant Nurseries. Nursery groundbeds in Florida, containing Philodendron and Diffenbachia, were drenched with Dasanit, Zinophos, Mocap, and Furadan as soil drenches from 100 to 800 ppm of the chemical. All chemicals gave good control of root-knot nematode after six weeks. All plants grew normally and were apparently healthy. (I) Orlando, Florida.

III-464-F

Improvements Obtained in Control of Foliar Diseases of Pecan. Experiments for control of scab and other diseases of pecan were conducted and significant data recorded in 3 counties in Alabama. Air blast and mist blower sprayers and fungicide application intervals were evaluated at several rates. Experimental results demonstrated that Duter (50W) of 0.3-0.4 lb/100 gal. gave outstanding control of scab, brown leaf spot, and sooty mold. (E-fg) Alabama Agr. Exp. Sta.

III-471-B

Forests

Distribution of Fine Spray Particles from Aircraft. An equipment system has been developed for aerial application of fine particles of spray material. Freon 12 used in a bi-fluid system provides rapid expansion and breakup of particles of material when they leave the nozzles. Aerosol spray droplets ranging in size from 120 microns downward are produced. Estimated mass median diameter of droplets is 60 to 80 microns. The developed system will carry 700 gallons of spray material and deliver it at a rate of 90 gallons per minute through 237 nozzles. In testing the system Zectran in Dowanol TPM was applied at a rate of one ounce per acre. Each load covered 3,680 acres and required 7.8 minutes to apply. (I) Missoula, Montana. III-5-A

Further Clues in the Control of Dutch Elm Disease. Naturally-occurring bacteria and fungi flushed from healthy elms in Maine by centrifugation were tested for potential antagonism to *Ceratocystis ulmi* in plate culture. Three bacterial isolates inhibited the fungus, but cell-free filtrates did not. The data suggest possibility of antagonism in vivo that might prevent initial infection. (E-fg) Maine Agr. Exp. Sta. III-5-B

Eradication of Fusiform Rust Infections. Sodium arsenite, applied directly to the surface of the gall, has given what has been termed "chemical eradication" of established fusiform infections on field and seed orchard pines. These results have held over a period of 5 years and very little phytotoxicity has resulted from the sodium arsenite applications. At present the technique cannot be used in large-scale field operations because of economic reasons, but it is already being used in many areas of the South on high-value seed orchard trees. (I) Macon, Georgia. III-5-B

Fungicidal Control of Fusiform Rust. Fusiform rust infection of southern pines can be prevented by the application of fungicides prior to spore dispersal. This is economically feasible only in high value areas--nurseries and select seed orchards. Failure to apply the fungicide in time may nullify a dozen previous sprayings. Studies have defined the conditions under which infection can occur, and predictable synoptic weather patterns have been correlated with high infection periods. These findings will make spraying for rust control much more reliable. (I) Gulfport, Mississippi. III-5-B

Control of Dothiostroma Needle Blight. Epidemiology and control of *Dothiostroma* needle blight on Austrian pine and ponderosa pine were studied in eastern Nebraska. Good control was obtained with bordeaux mixture and other copper fungicides. Only two properly timed applications of bordeaux mixture provided excellent control. (I) Lincoln, Nebraska. III-5-B

Better Timing for Control of Needle Cast. Grafted scions susceptible to infection by Davisomyces medusa, a needle cast fungus, showed that the fungus is capable of incubation in pine foliage for a period of at least 2 years prior to development of obvious symptoms and fruiting bodies. There is no evidence that the fungus is capable of systemic development, so that incubation probably occurs within the foliage. Control measures applied in ignorance of such prolonged incubation periods would be ineffective. (I) Fort Collins, Colorado. III-5-B

Improved Evaluation of Deterioration of Wood and Wood Products Developed. An improved procedure for evaluating preservative-treated insulating board was developed in Minnesota. A 24-hour spore germination test was developed which provides accurate evaluations of preservative treatment in wood and in less time than the 3 months required for the soil-block test now used as the standard. Insulating board products stored outside have higher moisture contents when protected by partial or complete plastic coverings, but fewer microorganisms. One wood rotting fungus was recovered from the board. Aspergillus sydowi is able to cause spotting of coated board. (E-fg) Minnesota Agr. Exp. Sta. III-5-B

New Disease Appraisal Method Cuts Fire Use. Prescribed fire is often used for control of brown-spot needle disease in long-leaf seedling stands. In southwest Alabama, two different methods were used to determine whether a brown-spot burn was needed. The "crop-seedling method," indicated that the area should not be burned. In contrast, the "mean-seedling method" indicated that a burn was needed. On the basis of the "crop-seedling method" the area was not burned and a year later the crop seedlings were growing well. Benefits were threefold--reduced cost, reduced air pollution, and satisfactory regeneration. (I) Brewton, Alabama. III-5-B

Biological Activity Relating to Structural Changes in Aryl N-Methylcarbamates. As part of the basic research program of the Forest Service on new and safer forms of chemical insecticide, 25-aryl N-methylcarbamates with a variety of substituents on both the ring and carbamyl portions were tested. Biological activity was measured by topical application in acetone to spruce budworm larvae and by oral administration to mice. Examples of biologically active carbamates are 4-dimethylamino-3, 5-xylyl N-methylcarbamate (Zectran) and 4-methylthio-3-tolyl N-methylcarbamate. They gave an LD₅₀ for the spruce budworm larvae at 1 to 15 mg/g. and an acute oral LD₅₀ for the mice at 20 to 50 mg/kg. Addition of an N-acyl substituent to the carbamyl moiety maintained biological activity on the spruce budworm but decreased the toxicity to mice to the point where a dosage of 1 g/kg produced no visible effect. Thus, it is possible, by acetylation, to substantially lower the acute oral toxicity to mammals without significantly altering the toxicity of these compounds to the spruce budworm. (I) Berkeley, California. III-5-C

Formulation and Structure of Residual Insecticides Affects Bark Beetle Control. The efficiency of surface and tissue (subsurface) deposits of synthetic organic insecticides was investigated using DDT, dieldrin, dinitrocresol, endrin, heptachlor, and lindane. Application in solution form to fiberboard panels in the laboratory resulted in spontaneous crystallization by all materials. Field tests with lindane and dieldrin indicated that tissue deposits were slightly but consistently more effective than surface deposits in killing bark beetles in infested bark and in protecting green logs. (I) Berkeley, California. III-5-C

Helicopter Spray Systems. Equipment was developed for spraying virus and carrier solutions from a helicopter to control Tussock moth larva on Douglas fir trees. Narrow band droplet sizes produced were 106 and 230 microns mmd. Twenty-one day bioassays on sprayed forest trees indicated about 50 percent mortality, reaching 95 percent mortality after 50 days. (I) Forest Grove, Oregon. III-5-C

Low-Volume Application of Malathion Effective Against Larch Casebearer. The application of 8 fluid ounces (0.6 lb. actual) per acre of technical grade malathion to control the larch casebearer effected 96 percent reduction, as compared with nearly 100 percent control with the "standard" treatment of 1/2 lb. malathion in 1 gallon fuel oil per acre. This test was conducted in the northern Rocky Mountains, where three-fourths of the larch stands now are infested by this insect. (I) Moscow, Idaho. III-5-C

Plastic Spray Deposit Cards. A new type of plastic card has been developed for assessment of spray deposits of water-base formulations superior to previously used Kromekote cards. Smaller droplets are visible and they spread in a uniform circle. The spread factor for these cards has been determined. (I) Corvallis, Oregon. III-5-C

Improved Residue Analysis of Zectran. Increased sensitivity of analysis of Zectran residues on foliage was obtained by using a modification of the cleanup procedure of Marquardt and Luce in combination with gas-liquid chromatography and an electrolytic conductivity detection system. With this procedure it is possible to determine 10 to 20 mg. of Zectran at the 0.1 ppm level. (I) Berkeley, California. III-5-C

Systemic Insecticide Controls Tip Moth. Granular phorate (10 percent) was safely and effectively applied by means of a specially designed, inexpensive applicator to control the Nantucket pine tip moth in a seed orchard in Virginia. Trees 3'-5' tall received 20 grams of phorate, trees 5'-8' received 40 grams. The control obtained was significantly better than that by the standard treatment with cygon using a hydraulic sprayer. (I) Athens, Georgia. III-5-C

Systemic Insecticides May Affect Tree Seed Germination. Thousands of dollars are spent each year in efforts to protect pine seedlings in the nursery from the damaging effects of insect attack. Many chemical companies are trying to formulate systemic insecticides which can be applied to seed before it is sown and which will supply long-term protection by being incorporated into the growing seedling. However, before this can be successfully accomplished, it is necessary to determine the effects of these preparations on seed germination. Recent results of tests of 10 systemic insecticides show that at low-dosage rates four of the insecticides tested did not inhibit germination. The degree of protection from insect damage obtained at these rates remains to be determined. (I) Macon, Georgia. III-5-C

Herbicide Doses Reduced Without Loss of Effectiveness. At present, stem injection of herbicides is the most popular control method for eliminating weed trees but efficiency can be increased. Results from a study in Michigan that can reduce costs include the following: (1) Only about one-fourth the quantity of the amine salt is required to kill pole-sized northern red oak compared to ester formulation in spaced stem injections; (2) only about one-half the quantity of the amine salt is required per tree during the growing season compared to the dormant season; (3) spaced injections may be made at any height along the stem, and (4) hardwoods with large spreading crowns and forked stems can be killed more easily by edge to edge injections completely around the stem with low quantities of 2,4,5-T than by spaced injection. (I) East Lansing, Michigan. III-5-D

Rabbit Repellent Not Effective on Stored Tree Seedlings. Most effective adhesion of TMTD rabbit repellent to Douglas-fir seedlings is obtained when applied during warm, dry weather, but the contrasting cool and moist weather requirements for successful outplanting frequently necessitates holding treated seedlings in cold storage. A study near Olympia, Washington, showed that growth, survival, and repellency of treated seedlings were affected adversely by storage before outplanting. Therefore, Douglas-fir seedlings should be sprayed with TMTD repellent just before outplanting. If weather conditions for outplanting become unfavorable, seedlings should be left in nursery beds. (I) Olympia, Washington. III-5-G

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TARGET IV

TO STUDY THE TOXICITY, PATHOLOGY AND METABOLISM OF PESTICIDES AND INVESTIGATE LEVELS, EFFECT, AND FATE OF THEIR RESIDUES IN PLANTS, ANIMALS AND THEIR PRODUCTS, AND IN OTHER PARTS OF THE ENVIRONMENT

General

Adsorption of Pesticides by Clays. Paraquat was added to montmorillonite and vermiculite in amounts up to the adsorption capacity of the clay. The clay plus paraquat was subsequently added to cups of sand in which cucumber test plants were grown. Montmorillonite provided protection against the paraquat to the extent that at up to 90% saturation no plants were killed by the end of 10 days, while the check (no clay) showed complete kill after two days. The vermiculite provided no protection other than a slight retarding of availability of paraquat to the plants. Malathion was adsorbed by Na, Ca, Al, and La montmorillonite to a maximum of 1 millimole per milliequivalent of clay CEC. Infrared studies indicated that the mechanisms of adsorption included ion-dipole bonding between the exchangeable cation of the clay and the carbonyl oxygen of the Malathion. (E-fg) North Carolina Agr. Exp. Sta.

IV-1-A

Mechanism of Amiben Action. Research on the mechanism of action of amiben in Illinois revealed significant correlations between the log percentage composition of amiben, amiben-x, and N-glucosyl amiben in the methanol-soluble fraction of seedlings, and the log of the concentration required for 50 percent inhibition of radical elongation. The correlations were negative for amiben and amiben-x, but positive for N-glucosyl amiben. (I) Urbana, Illinois.

IV-1-A

Amiben Metabolism in Plants. The metabolism of amiben to an N-glucoside by several plant species and tissues together with the effect of light and darkness on this pathway were determined at Fargo, North Dakota. An enzyme from soybean which is responsible for the biosynthesis of N-glucosides was partially purified and characterized. The absorption and translocation of endrin after root and leaf surface application was determined. The metabolism of monuron and diuron by leaf discs of several plant species was demonstrated. The inhibition of urea herbicide metabolism by insecticidal

carbamates was also shown. A biological assay system was developed to follow herbicidal urea metabolism in isolated leaf discs. Several metabolites of CIPC in soybean were isolated and partly characterized. (I) Fargo, North Dakota.

IV-1-A

Amitrole Biosynthesis. The biosynthesis of amitrole from formaldehyde and amino-guanidine by mitochondria has been reported. Research at Beltsville, Maryland, revealed that the formation of amitrole was by a chemical synthesis and that the mitochondria were not necessary for the reaction. (I) Beltsville, Maryland.

IV-1-A

Insecticide Antidotes Ineffective on Honey Bees. The LD-50 toxicities in $\mu\text{g}/\text{bee}$ when tested in acetone by topical application were for: carbaryl 0.2 to 2.0; parathion .04 to .08; Azodrin .02. When 3 antidotes were fed in sugar syrup, atropine sulfate was slightly toxic at 1%, P2S was safe at 1%, and PAM killed at 0.1%. Antidotes were ineffective when supplied in sugar solutions or in drinking water. Topical applications of 8 μg atropine plus 80 μg P2S failed to save bees treated with 2 μg carbaryl or 0.2 μg crotonamide. When atropine was injected, 4 $\mu\text{g}/\text{bee}$ was toxic and 2 μg with or without 20 μg P2S gave little reduction in kill with crotonamide, carbaryl, or parathion. (I) Tucson, Arizona.

IV-1-A

Soil Microorganisms Metabolize Organic Arsenical Herbicides. In work at Beltsville, Maryland, four soil microorganisms isolated in pure culture degraded MSMA- ^{14}C to $^{14}\text{CO}_2$ and arsenate in liquid culture solutions. Breakdown of MSMA in soils is slow, since only 2-10% of the labeled carbon was released from soils after 60 days. (I) Beltsville, Maryland.

IV-1-A

Effect of Azodrin on Honey Bees. Four normal bee colonies and one food-depleted colony were exposed to two and three applications of Azodrin at 1.5 pt/acre. Knockdown occurred in 15 minutes with aerial sprays; topical applications in the laboratory gave knockdown in 150 minutes. Nectar and pollen collected by bees from sprayed fields was not toxic when fed to worker bees or used to rear brood. Covering with burlap or polyethylene was ineffective in protecting bees. Present indications are that single applications applied before active foraging in the morning have only a slight effect on the colony. (I) Tucson, Arizona.

IV-1-A

Effect of Carbaryl on Honey Bees. One application of carbaryl spray on September 4 to a 55-acre field of canning sweet corn located 1/2 mile from an apiary maintaining valuable breeder queens in holding colonies resulted in a loss of two thirds of the queens and a weakening of the surviving colonies, adversely affected their overwintering. Corn pollen brought into the hives two days after spraying contained 7.62 ppm carbaryl and 0.092 ppm free naphthol. (I) Madison, Wisconsin.

IV-1-A

Herbicides Alter Biochemical Reactions of Soil Bacteria. Microrespirometer studies indicated that the enzyme, fumarase, of bacteria was particularly sensitive to 2,4-D. Enzyme studies with crude cellular extracts again indicated the extreme sensitivity of fumarase to 2,4-D. By enzyme purification and other biochemical studies it became apparent that 2,4-D inhibited fumarase only if adenylic acid (AMP) was also present. AMP alone at relatively high concentrations will inhibit fumarase. However, at low concentrations of AMP, 2,4-D is required to exhibit the inhibition. It appears that 2,4-D potentiates the inhibitory effector action of AMP on fumarase. Indole acetic acid, a natural plant auxin, is ten times as effective as 2,4-D. The evidence indicates that plant auxins and their analogues act by potentiating the effector activity of nucleotides. (E-fg) Louisiana Agr. Exp. Sta.

IV-1-A

Low Dosage of UC-21149 Controls Aphids Without Damage to Bees. Union Carbide UC-21149 used at 0.1 g of 10% granular material per soil pot (a #10 can) gave excellent control of aphids and several other harmful insects but also killed most of the foraging wild bees when they visited the flowers. When lower dosages of granular 10% UC-21149 were applied to plants and they were visited by nesting alfalfa leaf-cutting bees control of the green peach aphid for 10 days was achieved with 0.012 g with no apparent damage to leaf-cutting bees. (I) Logan, Utah.

IV-1-A

o,p'-DDT Effect Upon Reproductive Tissues of Mammals and Birds. 15-20% of technical DDT which is used throughout the world for pest control is o,p'-DDT. o,p'-DDT was found to have estrogenic effects similar to those of estradiol, the female sex hormone, in rats, chickens and quail. The uterus in the rat, and the oviducts in the chickens and quail, increased in size after o,p'-DDT administration and estrogenic biochemical alterations occurred. p,p'-DDT, the major component of technical DDT, was without effect. o,p'-DDT was found to accumulate in the animals to a lesser extent than p,p'-DDT. (I) Beltsville, Maryland.

IV-1-A

Herbicide Inhibitors of RNA Synthesis. Twenty-two herbicides were investigated with respect to their ability to inhibit, either directly or indirectly, synthesis of RNA. Fourteen of the herbicides were inhibitory. Ioxynil, DNBP, propanil, pyriclor, and CIPC were the most inhibitory. (I) Raleigh, North Carolina.

IV-1-A

Microbial Degradation of Dicamba. In extramural research in Illinois, microbial degradation appeared important in the detoxification of the herbicide dicamba in soil. Also, dicamba was readily leached in soils except at pH levels more acidic than 4.2. (E) Urbana, Illinois.

IV-1-A

Disposal of Pesticides and Pesticide Containers. Research was initiated (1) to determine the degradation requirements of pesticide chemicals by thermal, chemical, biological or other means; (2) to determine the requirements for pesticide containers that can be safely disposed of; and (3)

to develop specifications for equipment and facilities proposed for safe disposal of waste pesticides and their containers. (E) Mississippi Agr. Exp. Sta. IV-1-A

Herbicides in Irrigation Water and Their Effects on Crop Yields. In Montana, amitrole-T caused no reductions in yield or other noticeable effect on beans, sugarbeets, corn, or spring wheat when applied at rates of 0.04, 0.4, or 4.0 lb/A in furrow irrigation water. Picloram in irrigation water at 0.04 lb/A reduced the yield of beans the first year after treatment. Residual effects were still severe in the second year and were significant in the third year. At 0.4 lb/A or more, picloram eliminated all bean growth even in the third year after treatment. It was only slightly less damaging to sugarbeets at equivalent rates. Spring wheat was severely damaged at 4 lb/A of picloram the first year while sweet corn showed injury but no yield reduction. Lower rates caused no injury to spring wheat or sweet corn and none of the rates caused injury in subsequent years. (I) Bozeman, Montana. IV-1-A

Long-term Persistence of Chlorinated Hydrocarbon Insecticides in Soils. After 15 years, large amounts of insecticide were recovered in plots at Beltsville, Maryland, initially receiving high rates of application. Percentages of the initial quantity remaining were: technical aldrin - 40, chlordane - 40, endrin - 41, heptachlor - 16, Dilan - 23, isodrin - 15, BHC - 10 and toxaphene - 45. The average residual percentage of DDT in three soils after 17 years was 39%. (I) Beltsville, Maryland. IV-1-A

Pesticide Metabolism in Barley. Absorption and translocation studies have been made with the insecticide MCA-600 and the fungicide D-735 in barley. The major metabolites of the insecticide MCA-600 in barley have been isolated and partly identified. A whole plant radiorespirometer system has been developed for following the metabolism of one pesticide in the presence of another. Gas chromatographic procedures for the determination of chloroanilines and tetrachloroazobenzene have been developed. (I) Fargo, North Dakota. IV-1-A

Mobility of Pesticides. A major source of environmental contamination results from movement of a pesticide from its site of application. At Beltsville, Maryland, the vertical mobility of over 30 pesticides in soils showed that the aromatic acid herbicides were the most mobile, the phenylurea and triazine herbicides intermediate and the insoluble chlorinated hydrocarbon insecticides were least mobile. (I) Beltsville, Maryland. IV-1-A

Effect of Environment on Propanil Metabolism. The effect of environment on propanil metabolism in rice was investigated at Fargo, North Dakota. Studies on the metabolic fate of propanil in rice, barnyard grass and peas resulted in the identification of several metabolites. Residues of one of these metabolites, 3,4-dichloroaniline, were found in rice grains. An enzyme was isolated and characterized from rice that hydrolyzes propanil. This enzyme was shown to be inhibited by organo-phosphate and carbamate insecticides. (I) Fargo, North Dakota. IV-1-A

Metabolic Inhibitions by an Oxime. The action of 3,5-dibromo-4-hydroxy-benzaldoxime-O-2',4'-dinitrophenylether on oxygen utilization by mitochondria was compared to action by bromoxynil and 2,4-dinitrophenol (DNP). The oxime-ether stimulated ADP-limited oxygen utilization, circumvented oligomycin-inhibited oxygen uptake, and inhibited respiration in the presence of excess ADP. Electron transport and phosphorylation inhibition patterns of the oxime ether more closely resembled those of DNP than those of bromoxynil. In both mitochondria and chloroplasts, the oxime ether interfered with electron transport and the production of ATP. Because of the dependence of the biosynthetic reactions of plants on ATP, any interference with its production can be anticipated to result in impaired growth and development. (I) Raleigh, North Carolina. IV-1-A

Pesticide Pollution of Farmstead Water Supplies. Laboratory studies were conducted to obtain background information concerning the adsorption of toxaphene, DDT and lindane by activated carbon. Commercially available carbon filters appear to effectively adsorb contaminants provided sufficient contact time is allowed. Ultrasonic mixing of carbon-water mixture did not prove as effective in speeding adsorption of contamination by carbon as did mechanical stirring. Water samples taken from cooperator's contaminated shallow well indicate only slight reductions in contamination level after pumping approximately 20,000 gallons. Conventional carbon filter installed on this system seems effective in reducing contaminant level but filter life is short due to plugging of the filter by sedimentation. (I) Watkinsville, Georgia. IV-1-A

Pesticide Pollution of Farmstead Water Supplies. The sampling of Maryland farmstead water supplies, begun in 1966, continues. Of 24 farm water supplies in Washington County, five contained chlorinated hydrocarbon pesticides at concentrations above 0.1ppb. Highest concentration to date was 0.8 ppb of BHC. Of 24 farm water supplies in Wicomico County, one contained chlorinated hydrocarbon pesticides above 0.1 ppb. Highest concentration to date was 1.0 ppb of TCNB. None of the above concentrations were above limits recommended in the Interim Report of the National Technical Advisory Committee on Water Quality Criteria to the Secretary of the Interior. A chlordane-contaminated well in Carroll County, Maryland, has been sampled for 18 months. Chlordane concentrations have fluctuated between 30 ppb and 4 ppb. A small active carbon filter installed on one branch of the system reduces chlordane concentration to acceptable levels at a flow rate of one gpm. (I) Beltsville, Maryland. IV-1-A

Plant Uptake of Chlorinated Hydrocarbon Insecticides from Soils. Work at Beltsville, Maryland, indicates that soybeans, wheat, corn, alfalfa, bromegrass and cucumber absorb residual insecticides from soils. Using radio-active insecticides, the order to uptake increased from DDT < dieldrin < endrin < heptachlor. This order is related to their water solubility. Organic matter was the most important soil factor influencing pesticide uptake. Increasing soil organic matter decreased uptake. (I) Beltsville, Maryland. IV-1-A

Synthesis of Propanil Analogs. Several analogs of propanil have been purified and synthesized for enzyme specificity studies at Fargo, North Dakota. Methods have been developed for the synthesis of ^{14}C ring-labeled 3,4-dichloroaniline and 3,4,3'4'-tetrachloroazobenzene. (I) Fargo, North Dakota.

IV-1-A

Thermal Decomposition of Pesticide Wastes. In extramural research at Mississippi Agricultural Experiment Station studies were initiated on methods to decontaminate and dispose safely of waste pesticides and their containers. Pure chemicals and formulations of 20 pesticides, including 13 herbicides, 4 insecticides, 2 fungicides, and 1 nematicide, were studied for thermal decomposition. Temperatures for combustion ranged from 250 to 879°C for pure chemicals and from 508 to 852°C for formulated products. Temperatures at or near 1,000°C appear sufficient to degrade 99% or more of most commercial pesticide formulations. These temperatures can be obtained with conventional incineration equipment. Studies included carbon combustion determinations, characterization of pyrolysis peaks of selected pesticides, dry ashing techniques, and degradation by several chemical agents. (E) State College, Mississippi.

IV-1-A

Metabolism of Triazine Herbicides in Plants. Elucidation of a new pathway for herbicidal 2-chloro-s-triazine metabolism in plants and its significance in selectivity has been achieved at Fargo, North Dakota. The effect of triazines and their metabolism on cyclic and non-cyclic photophosphorylation in isolated chloroplasts has been correlated with in vivo phytotoxicity studies. (I) Fargo,^m North Dakota.

IV-1-A

Recovery of 2,4,5-T From Oak Tissue. In Texas, recovery of 2,4,5-T from live oak (*Quercus virginiana*) tissue was increased when low levels of picloram were applied in combination with the 2,4,5-T. The ester of 2,4,5-T was recovered 30 days after treatment in root tissues of live oak plants sprayed with 2 lb/A of the 2-ethylhexyl ester of 2,4,5-T. (I) College Station, Texas.

IV-1-A

Mechanism of Selectivity of 2,4-DB Between Alfalfa and Broadleaf Weeds. The mechanism of alfalfa resistance to 2,4-DB results primarily from the synthesis of herbicidally inactive long chain chlorophenoxy compounds from the parent herbicide. Thus, production of 2,4-D in lethal quantities by beta-oxidation and subsequent translocation to sites of action is prevented. After the application of 2,4-DB to alfalfa in New York, (2,4-dichlorophenoxy) caproic and (2,4-dichlorophenoxy) decanoic acids were detected as well as limited amounts of (2,4-dichlorophenoxy) crotonic and (2,4-dichlorophenoxy) acetic acids. The methyl ester of (2,4-dichlorophenoxy) crotonic acid was rapidly reduced on the alfalfa leaf surface to the methyl ester of 2,4-DB and, subsequently, the aforementioned metabolites were formed. (I) Ithaca, New York.

IV-1-A

Ultrastructural Cellular Effects of Herbicides. In extramural research at Dartmouth College, trifluralin, 2,3,6-TBA, and 2,3,5,6-tetrachlorobenzoic acid killed dividing stipular leaf cells of the dicot Vicia faba without affecting dividing staminal hair cells of the monocot Tradescantia paludosa. Trifluralin also caused sticky chromosomes with dicentric bridges and acentric chromosomal fragments. Benzoic acid herbicides caused less stickiness of chromosomes than phenoxy-type herbicides. Picloram and pyrichlor acted as contact poisons and caused sticky chromosomes. Nitratin was a true mitotic poison and was selective at the cellular level by affecting Tradescantia at much lower concentrations than for Vicia. The effects of IPC and colchicine on ultrastructure of the African blood lily revealed that colchicine destroyed microtubules of the chromosome spindle fibers, whereas, IPC did not destroy microtubules but caused their disorientation. These two chemicals appeared identical in effects prior to ultrastructure evaluations. Initial evidence was obtained to indicate microtubule functions other than those known in spindle fiber functions. (E) Hanover, New Hampshire. IV-1-A

Natural Phytotoxin. Rhizobitoxin, a phytotoxin synthesized by Rhizobium japonicum, produces amitrole-like symptoms in plants. It inhibited methionine biosynthesis by action on the beta-crystathionase enzyme. (I) Beltsville, Maryland. IV-1-B

Affects of Physical Stresses on Cockroaches. Comparison of effects of physical and chemical stress have shown that certain physical stresses produce irreversible injury to the nervous system of cockroaches and that the symptom of prostration and paralysis resemble those induced by certain organic insecticides which act on the nervous system. The symptoms caused were prostration with hyperactivity of appendages, progressive paralysis and accumulation of air in certain crops. The hemolymph became toxic after a few hours and caused a flaccid-type of paralysis in cockroaches receiving injections of this blood. DDT induced prostration also produced a toxin which caused the same type of paralysis. This indicates a similarity of lesions produced in the nervous system of insects by entirely different types of stress. Naturally produced toxins possibly from the nervous system accumulate in the hemolymph of paralyzed insects. (E-fg) Kansas Agr. Exp. Sta. IV-1-C

Diagnostic Test for Hydroxyl Groups. Toxicologists and chemists have long needed a simple chemical test diagnostic of hydroxyl groups. Currently used methods are difficult, time-consuming, and often yield ambiguous data. To overcome these difficulties, a simple spot test diagnostic for hydroxyl groups was developed with 4(p-nitrobenzyl) pyridine. This reagent affords a sensitivity for alcohols in the microgram range on cellulose thin-layer plates. Amino, ester, and ether groups do not interfere with the test but carboxylate and phenolic substituents do. (I) Fargo, North Dakota. IV-1-C

Isolation and Characterization of Insect Esterases. The action of detoxifying esterases may be involved in species specificity in poisoning by organophosphates and in the acquired resistance of some insects to certain of these insecticides. In addition the inhibition of these enzymes may account for insecticide toxicity under conditions in which no impairment of neural function has occurred. Esterases are present in the cockroach midgut and gastric ceca, fat body, and hemolymph that are capable of hydrolyzing long-chain triglycerides. Recent experiments on lipid synthesis and release by the fat body indicated a possible role of esterases in lipid metabolism in the fat body and hemolymph. (I) Fargo, North Dakota. IV-1-C

Insecticides Affect Mineral Metabolism. The continual feeding of insecticides at levels well below those allowed by Federal Regulations may alter mineral metabolism and result in adverse changes in reproductive performance in the rat and in survival and development of normal progeny. When dietary copper levels were low, 1 ppm or very high, 300 ppm, survival to weaning was poor and was worse in the presence than in the absence of insecticides. Heart lesions were seen occasionally in the absence of insecticides but were a frequent finding and more severe when the low copper diet contained insecticides. Manganese metabolism also was affected by low intakes of insecticides with the effect apparent in succeeding generations. The manganese content of the livers of the female rat and her young was significantly higher when the manganese level of the diet was 1500 ppm compared to 100 ppm; when similar diets contained insecticides, the amount of the manganese in the liver was significantly higher in the mother but in the young did not differ from the level observed in the absence of insecticides. (E) Lafayette, Indiana and Gainesville, Florida. IV-1-C

Mite Resistance to Chemicals. The evolution of resistance in races with the following population structure (1) a restricted initial gene pool, (2) a hybrid swarm, (3) a system based on Wright's model for maximum rate of evolution, has been followed. Eleven field populations have been evaluated (both orchards and glasshouse) and the presence of a supergene complex has been isolated. (1) The breeding system and (2) the genetic system in wild populations have been established to be a primary importance necessary as a precursor for all resistance studies which attempt to predict changes in resistance levels. The stereotyped behavioral responses, which control migration through the plants, has been found to be based on color vision. The behavioral types, the sedentary phase = green negative photo response and migratory phase = green positive photo response, are switched by ambient humidity and feeding activity. (E-fg) Massachusetts Agr. Exp. Sta. IV-1-C

Degradation of Pesticides by Light. Of interest to scientists and the general public is the persistence of pesticide compounds once they accumulate in the soil. In order to obtain some information on time of persistence, degradation products and methods of decontamination, a series of studies have been initiated in the Division. In a study at Fort Collins, Colorado, DDT

exposed to intense ultraviolet light degrades to a number of products. DDE, DDD, DDC=O, DDOH, DDA, and BA have been identified, and three other products have been isolated but not identified. (I) Fort Collins, Colorado.

IV-1-C

Persistence of Pesticides in the Soil. Soil water content and soil temperature affected persistence lindane and methyl parathion in acid soil. In general, persistence was greater in a dry soil than in a wet one, and greater at lower temperatures than at high ones. Losses were slight after 3 days of incubation, but increased with time. Concentration levels ranging from 0.5 to 5.00 p.p.m. in the soil had no effect on percentage losses with time. (I) Watkinsville, Georgia.

IV-1-C

Pesticide Content in Plants. Field studies with dieldrin on wheat and corn showed some accumulation of dieldrin in leaves but very little in stems. A hypothesis that the accumulation of dieldrin in the leaves resulted from aerial contamination rather than uptake through roots, was confirmed by greenhouse studies in which the soil treated with dieldrin was covered to prevent aerial contamination. (I) Beltsville, Maryland.

IV-1-C

Loss of Pesticides by Volatilization. Volatilization has been suspected as a major source of unaccountable losses of pesticides in experimental work. Recent studies show this to be a major pathway for some chlorinated hydrocarbons such as dieldrin, DDT, and lindane. Results show rate of vaporization to be dependent upon temperature, soil water content, and the concentration in the water surface. It is not related to the amount of water evaporated. The nature of the soil colloid, mineral or organic, also influences the degree of volatilization. (I) Riverside, California and Fort Collins, Colorado.

IV-1-C

Pesticide Movement and Persistence in Agricultural Watersheds. Pesticide residues in soils and losses in runoff were evaluated on three watersheds. Concentrations of toxaphene and DDT in surface runoff and ground water were less than 1.0 ppb. Toxaphene tended to be concentrated in the top foot of soil, whereas, DDT was found throughout the profile. Between 10 and 20 percent of DDT and toxaphene applied during the past 10 years were recovered from the soil profile. At another location, land treated at the rate of 5 pounds per acre yielded runoff containing an average of 0.10 ppb whereas, runoff from land receiving no dieldrin contained 0.03 ppb. After 16 months, only 40 percent of applied dieldrin remained in the soil. Removal by crop surface runoff and erosion accounted for only a small fraction of this loss, and there was no evidence of movement in the soil below plow depth. (I) Riesel, Texas and Coshocton, Ohio.

IV-1-C

Residue Analyses in Research Program. During the past year 3,763 residue analyses were conducted in support of various entomological research programs. Another 808 analyses were conducted under the cooperative study with the Human Nutrition Research Division to determine bromide, chloride, and phosphine fumigant residues in wheat, milling fractions, dough, bread, and rolls to learn the effects of repeated fumigation of stored wheat on quality and nutritional factors.

Methods were developed, adapted, or improved for the analyses of DDT, lindane, pyrethrins, diazinon, fenthion, and Gardona by gas-liquid chromatography.
(I) Savannah, Georgia. IV-1-C

Microbial Degradation of Pesticides. Two degradation products of DDT are DDD and DDE. Both of these were found to be fairly stable in soils under both aerobic and anaerobic incubation conditions. A spore-forming, gram-positive bacillus was isolated from a soil amended with DDT. In thioglycollate medium, this organism converted 27 percent of DDT present to DDD in nine days. Other studies with dalpon showed that breakdown in five soils was not related to the total population of bacteria capable of this breakdown. (I) Fort Collins, Colorado and Beltsville, Maryland. IV-1-C

Pesticides in Surface Runoff. Simulated rainfall on a bare soil having 5 percent slope and treated with atrazine at 3 pounds per acre, resulted in surface runoff losses of less than 0.1 pound per acre. The amount in surface runoff decreased as time between application of herbicide and initiation of rainfall increased. Endrin was applied to sugarcane at another location at the rate of 0.3 pounds per acre. At harvest, only 0.1 percent had been lost in runoff, 5 to 6 percent remained in the soil unchanged, 4 to 5 percent as degradation products, less than 1 percent in the cane plant. Much of the 85 percent unaccounted for is believed to have been lost by volatilization.
(I) Watkinsville, Georgia and Baton Rouge, Louisiana. IV-1-C

Anatomical Responses of Western Ironweed to Picloran. Foliar treatments of picloram in Nebraska induced rapid vascular cambium activity in western ironweed leaves. Increased meristematic activity was followed by destruction of the phloem parenchyma, sieve elements, and companion cells. Cell destruction in the vascular bundle was simultaneous with that in the mesophyll.
(I) Lincoln, Nebraska. IV-1-D

Adsorption of Pesticides in Soils. In studying the adsorption of amitrole and prometone, adsorption was found to be influenced by soil acidity. Under mildly acid conditions, the retention by organic matter is more important than that by clay. (I) Beltsville, Maryland. IV-1-D

Climatic and Soil Factors Influencing Herbicide Activity and Persistence.

The initial and residual toxicities of atrazine, ametryne, prometryne, and diuron in 13 different soil types found in Puerto Rico have been studied under greenhouse conditions. The results of studies on initial toxicity indicated that ED(50) values of the above mentioned herbicides varied greatly with different soil types. In simple correlation analyses, ED(50) values of the four herbicides were positively correlated with organic matter content of the soil and with cation exchange capacity, exchangeable calcium and exchangeable magnesium. Multiple and partial correlation analyses verified that organic matter was the determinant factor with respect to the initial toxicity of herbicides. The lack of correlation between ED(50) values of herbicides and per cent of clay suggested that clay content has a minor effect on herbicide performance. (E-fg) Puerto Rico Agr. Exp. Sta.

IV-1-D

Diffusion of Cotoran in Soil. The effect of nitrogen fertilizer sources, rates, and equilibrium time upon the self-diffusion of Cotoran in Crowley silt loam was determined. For comparative purposes the diffusion of Cotoran was carried out in glass beads and in an aqueous-agar paste. The self-diffusion of Cotoran in the aqueous glass bead system was $2.03 \times 10^{-6} \text{ cm}^2/\text{sec.}$ The diffusion in agar was affected by both the fertilizer and the time of interaction of the fertilizer and Cotoran. The effect of fertilizer was to increase the rate of diffusion for the 67#/A nitrogen application, but to decrease the rate for the 132 and 264 pound-nitrogen levels. The diffusion of Cotoran in Agar and glass beads was of the same order of magnitude, $2 \times 10^{-6} \text{ cm}^2/\text{sec.}$ as compared to the diffusion in Crowley soil which was of the order of $3 \times 10^{-7} \text{ cm}^2/\text{sec.}$ This rate of diffusion is about the same as for the Sr ion in soils, which implies that Cotoran can move rapidly in a soil. (E-fg) Arkansas Agr. Exp. Sta.

IV-1-D

Effect of 2,4-D on Metabolism. 2,4-D affected the $^{14}\text{CO}_2$ pattern from glucose, and this effect was more pronounced at higher temperature and was insignificant at low temperature, $^{14}\text{CO}_2$ production from specific-labeled glucose differed greatly with positions of labeling, which reflected directly the nature of catabolic breakdown. Several labeled organic acids were also used as substrate. (E-fg) Oregon Agr. Exp. Sta.

IV-1-D

Fungus Growth Inhibited by Atrazine. Investigations of organic residue effects on root-infecting fungi have involved soil-applied herbicides as well as plant residues. In the herbicide work, emphasis is on Sclerotium rolfsii (pathogen) in its association with Trichoderma viridie (saprophyte). Atrazine in soil at a low concentration (8 ug/g of soil) stimulated the pathogen, but concentrations of 20, 40, and 80 ug/g decidedly inhibited the fungus. This was reflected in analysis of CO_2 evolved, $\text{NO}_3\text{-N}$ utilization, and oxalic acid production. T. viridie was little affected at 8 ug/g herbicide, but was greatly stimulated at all higher concentrations. (E-fg) Alabama Agr. Exp. Sta.

IV-1-D

Inactivation of Herbicides in Soils. Atrazine, simazine, prometryne, and 2,4-D labeled with C^{14} were applied to soil samples initially or after one or two prior applications of non-labeled herbicide. The rate of decomposition of 2,4-D was increased by previous treatment with 2,4-D but no such response was obtained with the triazines. Repeated applications decomposed at essentially the same rates as initial applications. Low availability of triazine carbon and lack of microbial response indicates that degradation is passive, incidental to metabolism of soil organic matter. Inactivation of atrazine and diuron was measured in the field at 3 locations. Inactivation was related to concentration of each herbicide in the soils in a manner approximating a first-order reaction. The half-life of atrazine ranged from 30 to 36 days and that of diuron from 58 to 128 days in these soils. Both of these herbicides were found to have mobility by leaching to the depth of the plow layer. (E-fg) Alabama Agr. Exp. Sta. IV-1-D

Interactions Between Herbicides and Soil Microorganisms. In three different soils treated with the herbicides Diquat and Paraquat at field rates, and at two to 10 times these recommended rates, ammonification and sulfur oxidation was slightly depressed in a silty clay loam but was increased in silt loams. Nitrification was stimulated by the lowest rate; the higher rates has little influence. Each chemical caused some decrease in soil respiration. Four of six species of bacteria tested could use the herbicides as sole sources of nitrogen and carbon. Analytical recovery of Paraquat from the different soils was correlated with soil type, specifically with cation exchange capacity, amount and kind of clay, and organic matter content. (E-fg) Oregon Agr. Exp. Sta. IV-1-D

Movement of 2,4-D in Soils. Movement of 2,4-D in soils is influenced by the exchangeable cation status but to a much less significant degree than in resins. The explanation for the differential movement appears to lie in the solubility of the resulting 2,4-D salts, with salts of the alkali metals being much more soluble than those of the alkaline earths. In natural soils, the mixed character of the exchangeable cations tends to reduce the effect of individual cations, with the result that only extreme differences in exchangeable cation percentage will lead to significant differential leaching rates. (E-fg) New Mexico Agr. Exp. Sta. IV-1-D

Microbial Decomposition of Phenylurea Herbicides. The herbicides monuron, diuron, and fenuron were found to be resistant to microbial degradation when tested in aqueous suspensions of eighteen different soils. The addition of energy sources (glucose or glycerol) or ammonium sulfate to the suspension, for the purpose of enhancing microbial activity, did not result in decomposition of any of the herbicides. (E-fg) Colorado Agr. Exp. Sta. IV-1-D

Nitrification Affected by Herbicides. The herbicides Diuron, Picloram, Ametryne, and Prometryne were applied at rates ranging from 1 to 100 ppm to several soils and incubated at field capacity at 24°C. Nitrification of 100 ppm applied ammonium nitrogen was studied for 8 weeks. The effect of the herbicides on the nitrifying organisms largely depended on soil types. Ametryne and prometryne applied at usual rates did not affect nitrification. Picloram and Diuron even at 2 ppm inhibited nitrification in some soils. Ametryne applied at 100 ppm resulted in nitrite accumulation in certain soils indicating inhibition of the Nitrobacter bacteria. Diuron increased bacterial growth, reduced the actinomycetes and was ineffective to fungi. Picloram also increased bacterial growth, reduced the actinomycetes, and increased the fungi. (E-fg) Puerto Rico Agr. Exp. Sta. IV-1-D

Picloram in Runoff Water From Treated Areas. In Arizona, small amounts of picloram were detected in the runoff water collected in July (0.017 ppm) and August (0.009 ppm) 1967 from treatments made on chaparral at El Oso in May 1965. No picloram has been detected leaving the area treated in 1966 on the Bumble Bee. Forage from an area on El Oso which received 3.3 lb/A picloram contained 20-30 ppm picloram at the end of the initial growing season after treatment. (I) Flagstaff, Arizona. IV-1-D

Inactivation of Herbicides in Soils. Atrazine, simazine, prometryne, and 2,4-D labeled with C¹⁴ were applied to soil samples initially or after one or two prior applications of non-labeled herbicide. The rate of decomposition of 2,4-D was increased by previous treatment with 2,4-D but no such response was obtained with the triazines. Repeated applications decomposed at essentially the same rates as initial applications. Low availability of triazine carbon and lack of microbial response indicates that degradation is passive, incidental to metabolism of soil organic matter. Inactivation of atrazine and diuron was measured in the field at 3 locations. Inactivation was related to concentration of each herbicide in the soils in a manner approximating a first-order reaction. The half-life of atrazine ranged from 30 to 36 days and that of diuron from 58 to 128 days in these soils. Both of these herbicides were found to have mobility by leaching to the depth of the plow layer. (E-fg) Alabama Agr. Exp. Sta. IV-1-D

Interactions Between Herbicides and Soil Microorganisms. In three different soils treated with the herbicides Diquat and Paraquat at field rates, and at two to 10 times these recommended rates, ammonification and sulfur oxidation was slightly depressed in a silty clay loam but was increased in silt loams. Nitrification was stimulated by the lowest rate; the higher rates has little influence. Each chemical caused some decrease in soil respiration. Four of six species of bacteria tested could use the herbicides as sole sources of nitrogen and carbon. Analytical recovery of Paraquat from the different soils was correlated with soil type, specifically with cation exchange capacity, amount and kind of clay, and organic matter content. (E-fg) Oregon Agr. Exp. Sta. IV-1-D

Lack of Mutagenicity in Herbicides. In continuing extramural research with the Battelle Memorial Institute, there is no evidence to date that any herbicide should be classed as mutagenic. Most of the herbicides in current use have been evaluated. In addition, several compounds, to which some herbicides might be metabolized, were evaluated for mutagenicity, and negative results were obtained. These included four animline compounds and a tetrachloroazobenzene. In the tests being used, compounds such as 2-aminopurine and 5-bromouracil give positive results. A negative result in the test does not mean that the material could not influence the genetics of organisms by such means as chromosome doubling or chromosome breakage. Negative results are considered as evidence that the material in question is not affecting the DNA-coding processes. (E) Columbus, Ohio.

IV-1-D

Movement of Atrazine in Soil. Atrazine transport in a well-aggregated latosolic soil was measured in laboratory columns under both saturated and unsaturated conditions. Atrazine movement was not affected measurably by water flux, and water unsaturation resulted only in a higher peak concentration than was obtained with saturated flow. Chemical degradation by hydrolysis was found to have a significant effect on atrazine transport for flow periods greater than a few days. A computer program was developed to allow calculation of pesticide transport with variable adsorption, water content, and flow rate. Comparison of calculated and experimental results demonstrated the need for a more realistic accounting for adsorption-desorption characteristics and dispersion effects associated with variable microscopic flow velocities. (E-fg) Hawaii Agr. Exp. Sta.

IV-1-D

Soil Type Affects the Toxicity and Selectivity of Pre-Emergence Soil Herbicides. Fourteen of the major Colorado agricultural soils have been collected in relatively large quantities. Analysis of all major physical characteristics and some of the biological characteristics have been determined. Tests of the fate of two major soil applied herbicides, dicamba and picloram, applied to the above 14 soils under controlled moisture and temperature conditions are in progress. A detailed test of the effect of temperature, when moisture is not limiting, has nearly been completed for the behavior of pyrazon, a widely used soil herbicide in sugar beets. (E-fg) Colorado Agr. Exp. Sta.

IV-1-D

Animals

Alopecia Resulting from Diallate Exposure. Following loss of wool or hair due to the systemic effect of oral exposures to diallate (an organic herbicidal compound) in sheep and cattle, a chronic toxicological study is being conducted to investigate the histopathological and etiological factors involved. (I) Kerrville, Texas. IV-21-A

Metabolic Fate of the Triazine Herbicides in the Animal. Triazine herbicides metabolism is being determined utilizing the pathway of Atrazine metabolism as typical of these compounds. Urinary metabolites soluble in tetrahydrofuran-ethyl ether were isolated and purified. Three components of the organic-soluble fractions were identified by infrared, NMR, and mass spectrometry as the dealkylated products of Atrazine and represent approximately 15% of the urinary excretion of Atrazine. Water-soluble metabolites of Atrazine metabolism were purified by ion-exchange celluloscs, gel filtration, and derivatization. The identification of the triazine metabolites, including hypothesized metabolites, has been accomplished. The NMR spectra of the triazines suggest that they may exist in rather stable tautomeric forms. (I) Fargo, North Dakota. IV-21-A

Residue of a Chlorophenoxy Compound Causing Increased Toxicity. Erbon, a member of the 2,4,5-T family of herbicidal compounds, has been found to cause toxicity at a lower dosage level than others of the same family to cattle, sheep, and chickens. Due to the parent compound's rapid breakdown (4 hours) into 2 metabolites when orally dosed to sheep, only 40% was excreted in the urine and feces. Further investigation of residues in tissues may disclose the cause of its greater toxicity. (I) Kerrville, Texas. IV-21-A

Acetylcholinesterase Activity in Face Fly. Polyacrylamide gel electrophoresis of face fly head homogenate resolved at least 3 zones capable of hydrolyzing acetylthiocholine and revealed additional positive-staining material at the origin. When the homogenate was extracted with Triton X-100 the material at the origin was solublized and migrated into the gel. Cellular fractionation by differential centrifugation revealed that most of the acetylcholinesterase was associated with the mitochondrial and microsomal fractions. (E-fg) Missouri Agr. Exp. Sta. IV-21-C

Arsenic Residues in Tissues and Milk. Cattle and dairy cows dipped in 0.22% As_2O_3 solution were dipped twice with a 1-week interval between treatments and samples of the milk and tissues were analyzed. Residues found, calculated as arsenic (As), ranged from 0.01 ppm in the milk to 0.10 ppm in kidney. (I) Kerrville, Texas. IV-21-C

Fate of Hempa in House Flies. In vivo studies of the metabolism of the insect chemosterilant hempa (hexamethylphosphoric triamide) in house flies have shown that demethylation is the most important deactivating step. It was shown that the demethylation is an enzymatic process performed by insect microsomes. Microsomal preparations from carbamate-resistant and susceptible strains of house flies metabolized hempa to the same products as obtained in vivo. (I) Beltsville, Maryland.

IV-21-C

Metabolites of Insect Chemosterilant Hemel. The metabolism of the insect chemosterilant hemel (hexamethylmelamine) in male house flies was investigated. Four metabolites were detected in the flies and their feces. More active as a sterilant than any of these is N,N,N',N'-tetramethylmelamine, which was not detected as a metabolite but has been synthesized. The metabolic pattern of hemel has a marked similarity to that of hempa. (I) Beltsville, Maryland.

IV-21-C

Metabolism of DDT in Mosquitoes. DDT and its metabolic products have been determined by gas chromatography in mosquito larvae treated at 15° and 30°C. Although larvae are affected by lower doses at the cooler temperature the amount of C¹⁴ labelled DDT increased with increasing temperatures. Current research utilizes quantitative comparisons of DDT and its metabolites, particularly DDE and TDE using gas chromatography. Early experiments show no significant differences between DDT and DDE but quantities of TDE have not been finally determined. Different rates of formation of the metabolites may provide an explanation for the negative temperature coefficient. (E-fg) Minnesota Agr. Exp. Sta.

IV-21-C

Oxygen Consumption of Yellow Fever Mosquito. Periodicity of oxygen consumption in the yellow fever mosquito, Aedes aegypti has been further documented. The maximum oxygen consumption occurs between 4 and 6 PM. Least oxygen consumption occurs between 11 AM and 1 PM. Fast-acting insecticides dichlorvos (DDVP) and naled (Dibrom) did not differ in their effectiveness when compared at periods of high and low oxygen consumption. (E-fg) Minnesota Agr. Exp. Sta.

IV-21-C

Residue Analysis of a Screw-worm Chemosterilant. To keep screw-worms from reinvading the United States, up to two hundred million sterilized flies are released each week in a barrier zone on both sides of the U.S.-Mexico border. The number of sterilized flies could be greatly reduced by using a powerful chemical attractant to lure native screw-worm flies to a chemosterilant. The use of this method would depend on the hazard to man from the chemosterilant. Currently, the most effective screw-worm chemosterilant is N,N-tetramethylene-bis-1-aziridine-carboxamide. Residues of this chemical were determined on Phormia regina. Approximately 1/3 of the original dose of this chemical remained on the flies 3 weeks after treatment. (I) Fargo, North Dakota.

IV-21-C

Accumulation and Dissipation of DDT Residues in Beef Cows Fed Apple Pomace and in Their Calves. Apple pomace was used in a wintering diet (to calving) of pregnant beef cows. Apple pomace containing 1.2 ppm and 0.6 ppm DDT residues on an as-fed basis caused an accumulation of 13.7 ppm and 2.2 ppm, respectively, in the perianal fat of cows when fed as half the roughage during the wintering season. Diluting the apple pomace silage with corn silage lowered the residue level in perianal fat. A definite pattern of residue movement was established via the cows' milk and into the calves. The residue level in all cows was below legal tolerance by 16 weeks postpartum and below legal tolerance in the calves by 26 weeks of age. (I) Front Royal, Virginia. IV-22-A

Accumulation and Excretion of Heptachlor in Beef Cows and Their Calves. Ten pregnant cows received a residue-free diet and 10 received a diet containing 0.4 ppm of heptachlor for 4 months prior to calving. At calving, 5 cows in each group were transferred to the other diet and the experiment continued for an additional 8 months. Heptachlor residues in the perianal fat of cows fed contaminated feed during (1) gestation and lactation, (2) only lactation, (3) only gestation, and (4) neither gestation nor lactation reached levels of 1.53 ppm, 1.53 ppm, 0.69 ppm, and a trace, respectively. The calves from these cows contained 1.21, 1.10, .56, and a trace, respectively, at 5 months of age. In general, dissipation of heptachlor residues was very slow. (E) Front Royal, Virginia. IV-22-A

Excretion Patterns of Heptachlor in Beef Steers. An experiment was conducted to determine if the depletion rate of heptachlor residues could be increased in beef steers by limiting feed intake or feeding protamone (metabolic stimulant). Steers were "contaminated" by feeding a diet containing 0.15 ppm heptachlor plus heptachlor epoxide. The steers were then fed a residue-free diet (1) ad libitum, (2) limited to maintain body weight or (3) ad libitum plus protamone. The dissipation of heptachlor residues from the perianal fat of these steers was linear with time and similar for all treatments. The average dissipation rate was -0.0173 ppm/week. (E) Front Royal, Virginia. IV-22-A

Effect of Organic Phosphate Systemic Insecticides on Reproduction in Beef Cattle. Studies were conducted to investigate the effect of Ruelene^R and Coumaphos on embryonic survival and development in beef cattle and the physiological effects of Ruelene^R on beef cows. The use of Ruelene^R or Coumaphos did not cause an unusually large number of abnormalities. Administering 3 times the recommended level of Ruelene^R to pregnant cows did not cause changes in EKG and respiratory patterns or blood acetyl choline esterase activity up to 8 hours after treatment. Abnormalities were not caused by the two forms of Ruelene^R (8-R or 25E) or the carrier agent for 25E (MA51). (E and I) Montana, Nebraska and Beltsville, Maryland. IV-22-A

Physiological Effect of Aldrin on Growing Beef Cattle. Beef heifers were reared from 84 days to 17 months of age on either an all-concentrate or a roughage diet, supplemented with either soybean meal or urea, and with or without stilbestrol implants. Half of the heifers received 1 mg. Aldrin/kg. body weight, daily, from 42 days of age. Feeding Aldrin was associated with a higher heart rate and a higher concentration of blood lactic acid. The pesticide had no effect on growth rate or feed efficiency. (I) Beltsville, Maryland. IV-22-A

Quantitative Fate of Agricultural Chemicals in Beef Cattle. Procedures have been developed for (1) quantitatively studying the fate of C^{14} -labeled agricultural chemicals in beef cattle and (2) cannulating the ruminal veins of beef cattle to investigate the site of absorption of agricultural chemicals from the bovine digestive tract. The C^{14} excretion pattern for the progesterone 16-alpha, 17-alpha-dihydroxyprogesterone was established in beef heifers. All of the label was recovered in urine and feces (2.1 to 2.6% and 97.4 to 97.9%, respectively). Methoxychlor, fed at a level of 112 mg/kg. body weight did not significantly affect the excretion pattern of this progesterone. (I) Beltsville, Maryland. IV-22-A

Tissue Distribution of DDT Residues in Beef Cattle. An experiment was conducted to gain basic knowledge of the distribution of DDT residues among different fat storage depots of beef cattle. Total DDT residues (DDT, DDD, and DDE) appeared to be evenly distributed throughout the extractable fat of beef cattle and dose rate did not affect tissue residue distribution. A greater dose rate increased the level of total residues found in extractable fat before and after a 7-week depletion period. The relative proportions of DDT, DDD, and DDE were different in different tissues: 81, 11, 8, respectively, for milk fat; 67, 25, 8 for adipose tissue; 57, 29, 14 for blood and 54, 30, 16 for muscle. (I) Beltsville, Maryland. IV-22-A

Effects of a Bacterial Exotoxin to Exposed Cattle. Bacillus thuringiensis Berliner is being utilized as a feed additive to act as a retardant to fly larvae developing in feces of treated animals. The action of this bacteria is considered to be due to the production and concentration of an exotoxin, which may be responsible for undesirable side effects to cattle reproduction as well. Quantitation studies have been instituted to determine the exotoxin concentration in the blood as an aid to diagnosis. (I) Kerrville, Texas. IV-23-A

Toxicity from an Insecticide Related to Fetal-Adult Hemoglobin in Calves. When phorate, a plant organophosphorous compound, is administered to young calves in repeated doses, an erythropoietic disturbance occurs. This effect is related to a delayed replacement of fetal-type by the adult-type of erythrocyte and hemoglobin which may prove to be a diagnostic aid in young animal insecticide toxicosis. (I) Kerrville, Texas. IV-23-A

Carbamate (Mobam) Metabolism and Fate. A cow dosed with 1.9 mg/kg of Mobam-¹⁴C excreted 70% of the ¹⁴C in the urine within 8 hours, and 98% in the urine (87%) and feces (11%) after 24 hours. Milk residues of 1.35 ppm Mobam equivalents were found 8 hours after dosing and were below detectable levels at the end of 48 hours. Solvent extractions indicated that 95% of the milk residues were water-soluble products of Mobam metabolism. Tissue residues were below detectable levels 72 hours after dosing except in the brain (0.10 ppm) and kidney fat (1.05 ppm). Three sulfate and glucuronate conjugates of benzothiophene metabolites of Mobam metabolism have been isolated from the urine. (I) Fargo, North Dakota. IV-23-A

Chemical Form of DDT Affects Residue Problems. DDT and two of its degradation products, DDD and DDE were fed at identical levels to three groups of cows. DDT was excreted in milk as DDT and DDD in a 40:60 ratio. DDD and DDE were excreted only in the form fed. Total milk residues accounted for 5%, 7.6% and 25.5% of the DDT, DDD and DDE fed, respectively. The rumen was identified as the major site for DDT degradation with DDD being the major product. The findings demonstrate that the severity of any DDT residue problem is specifically related to the particular analog involved. (I) Beltsville, Maryland. IV-23-C

No Residues in Milk in Coumaphos Tests. Lactating dairy cows exposed to backrubbers treated with 1% and 2% coumaphos did not demonstrate residues in the milk. Treatment with either concentration resulted in complete control of horn flies. Also dairy cows sprayed daily with 1 ml of either 0.5% or 1% coumaphos or Shell SD-8447 twice daily did not show insecticide residues in their milk. (I) Kerrville, Texas. IV-23-C

GS-13005 in Cow Ration Presents no Milk Residue Problem. An organophosphate (GS-13005) has proven effective for controlling alfalfa weevils. This insecticide was fed to milking cows at rates up to 30 ppm of dry ration. At this level, which is at least twice that expected as a residue on alfalfa, no milk residues nor physiological abnormalities were observed. Investigations are continuing, but this insecticide now appears to be a safe one for alfalfa weevil control. (E) Virginia Polytechnic Institute, Blacksburg, Virginia. IV-23-C

Dursban Metabolized by Dairy Cattle. Corn silage containing at least twice the expected level of Dursban was fed to dairy cattle. No milk residues nor reduction in choline esterase activity was detected. The insecticide was almost completely metabolized with only small amounts of the oxygen analog being detected in the feces. The use of this insecticide on silage crops is considered to be a safe practice. (E) Georgia Coastal Plain Experiment Station, Tifton, Georgia. IV-23-C

House Flies Controlled with Larvicides. Cow manure is a primary breeding site for house flies on dairy farms. Inclusion of certain insecticides in cattle rations has resulted in manure which is toxic to house fly larvae. Seven insecticides were tested for their larvicidal effect against house flies. Three of these produced an encouraging amount of larvicidal activity in the feces. One of the materials, Gardona (Ent. 25841), has been investigated most extensively since it has shown greatest promise. Larvae mortality in the feces above 90% was observed in repeated laboratory tests when Gardona was included in the ration at 36 to 60 ppm. Reasons for some variability in results are being investigated. This material has not produced any milk residues nor undesirable physiological responses at levels up to 100 ppm over an extended period. Evaluation of Gardona under farm conditions in field stacked manure is now in progress. (I) Beltsville, Maryland.

IV-23-C

Residues of Diuron not Expected in Milk or Tissue of Dairy Cows. About 90% of ingested herbicide (Diuron) is excreted in the urine of dairy cows. Only at a level of 50 ppm in the feed was any residue detected in the milk. This is a much higher level than would be expected on forage crops following normal weed control practices. No Diuron residues were found in sheep tissues when fed at the 50 ppm rate. (E) Tuskegee Institute, Tuskegee, Alabama.

IV-23-D

Paralysis Due to a Carbamate Pesticide Corrected While Dosing Continued. A new approach in therapy, using a thiazide diuretic or an ammonium ion acceptor compound in the feed of poisoned swine, reversed the paralysis even though the administration of carbamate pesticide was continued. Further studies are in progress. (I) College Station, Texas.

IV-24-A

Metabolic Fate of Carbaryl in Poultry. Hens, surgically modified to permit the separate collection of urine and feces, were dosed with ring-or carbonyl-¹⁴C-labeled carbaryl at a rate of 10 mg/kg of body weight. Approximately 50% of ¹⁴C from the carbonyl label was recovered as carbon dioxide in 48 hours; whereas no radioactivity from the ring-labeled compound was detected in the expired gases. Of the ring-labeled carbaryl, 94% was excreted in the urine. The position of the label had little effect on the percentage (7.5%) of the dose that was excreted in the feces. The body tissues retained 2.6% of the activity of the ring-labeled dose. The ether-soluble metabolite in the urine was isolated and identified as naphthol. The isolation and identification of the more polar metabolites is in progress. Eggs were collected for 12 days and 0.32% of the dose was recovered. (I) Fargo, North Dakota.

IV-24-A

Malathion Residues in Poultry Products. The chicken is very effective in degrading malathion, for only one percent of the ingested pesticide is excreted as the intact molecule. A liver enzyme, thought to be carboxy-esterase, was isolated from chicken and rat liver and partially purified. The enzyme is very effective in degrading malathion. The enzyme activity

of fresh chicken liver is about one-sixth of that of the enzymes of fresh rat liver. The results show that the faster the rate of degradation, the less toxic malathion is to an animal. (E) Iowa State University of Science and Technology. IV-24-C

Residues of Shell SD-8447 in Poultry. Tissues of laying hens exposed to dusts of Shell SD-8447 mixed with the litter were found to contain very low levels (max. 58 ppb) of the insecticide in the fat and skin. Traces of SD-8447 were also found in the egg whites. (I) Kerrville, Texas. IV-24-C

ENT 27311 as a Miticide to Turkeys. To control Neoschrongasti americani and the downgrading lesions produced in turkeys during the summer months, this organophosphorous compound is being investigated as a control measure. Concomitantly, its toxic effect to turkeys is being studied. Acute and chronic toxicity trials indicate a greater tolerance in 4 - to 6-week old poults than in 16 - to 20-week old turkeys. Feeding trials of older birds indicate a slight increased weight gain at 50 p.p.m. with a reduction at 100 to controls, both levels causing cholinesterase activity depression. Dusting trials indicate a direct relationship to oral toxic dosage levels. (I) Kerrville, Texas. IV-24-E

Quality of Poultry and Eggs. Malathion in the diet of young laying hens did not affect the nutritive value of the eggs or the eating quality of the cooked meat. Malathion was fed for 8-weeks at 100 ppm and 1000 ppm levels in the diet. Neither level produced any toxic effect. Residues of malathion (less than 0.5 ppm) were found only in chicken fat, egg whites and egg yolks. Taste panel evaluations gave no indication of an effect on flavor of the cooked meat. Chemical analyses of egg whites and egg yolks showed no effect on nutrients including proximate composition, fatty acid distribution, amino acids, and carotene. (E) Maspeth, New York. IV-24-E

Chronic Carbaryl Intoxication is Entirely Distinctive from Acute Intoxication. Swine poisoned acutely with carbaryl exhibited classical signs and lesions expected from a cholinesterase inhibitor. Those poisoned after repeated dosage showed signs only of posterior paralysis. Degeneration of the muscles and edema of parts of the brain were present at necropsy. (I) College Station, Texas. IV-25-A

The Effect of Pesticides on Residue Accumulation Rate and Production Traits. Swine were fed heptachlor, malathion and DDT. Lindane was used as a spray for external parasites on 4 market weight hogs at 10 times the recommended concentration of 0.05%. Twenty-eight days after lindane treatment all samples analyzed were well below the residue tolerance level of 4 ppm in fat. Heptachlor levels up to 2.8 ppm and one level each of DDT (34 ppm) and malathion (150 ppm) were fed to swine for 14 weeks. The treatments had no effect on the health, mortality, growth rate, or efficiency of the pigs. In pigs switched to the control diet for a 4-month period after treatment,

heptachlor and malathion residue were low enough to obtain market clearance, but were not in the case of DDT. (I) Beltsville, Maryland. IV-25-A

Pesticide Residues in Body Tissues. Determination for residues was made on loin, bacon, shoulder and ham samples from the pigs fed malathion, DDT, and the highest level of heptachlor (2.8 ppm). No malathion or mala-oxon was found in any sample. DDT and its analogs were present in tissues from pigs fed 34 ppm of DDT in excess of the tolerance limit of 7 ppm. Heptachlor, for which no tolerance level is established, was present in all samples from pigs fed the compound at levels ranging from 0.25 ppm in the loin to 1.59 ppm in ham fat and bacon. (I) Beltsville, Maryland. IV-25-A

Ammonium Salts Cause Elevation of Blood Sugar, Potassium, and Non-Protein Nitrogen. In acute poisoning of sheep by the chloride, sulfate, or carbonate of ammonia, or a mixture of the chloride, carbonate, and phosphate the toxic effects were identical and due to the ammonium ion. Blood pH was lowered while blood sugar, potassium, non-protein nitrogen, and amino acids were elevated. The increase in potassium seems due to massive cellular breakdown while the elevated blood sugar may be due to an adrenergic response or to an interference with glucose metabolism. The increase of amino acids indicates an overloading of the urea cycle. (I) College Station, Texas. IV-26-A

Chlorinated Hydrocarbon Metabolism, Accumulation and Excretion. The feeding and slaughter phases of an experiment designed to study the physiology of chlorinated hydrocarbon (dieldrin) metabolism have been completed. Statistical analyses of analytical data from the first replicate of 65 sheep indicated that level and source (fat or carbohydrate) of energy consumed had no effect, whereas the level and duration of feeding had a highly significant effect on dieldrin accumulation. Approximately 8% of a radiolabeled dieldrin dose was excreted in the urine. Solvents that extract dieldrin did not extract the urinary radioactivity. Chromatographic evidence suggests that two or more dieldrin metabolites are present in the urine. The animal, then, is capable of degrading dieldrin, a persistent insecticide, to water-soluble products. (I) Fargo, North Dakota. IV-26-A

Water Restriction and Its Potentiating Effect on Propazine Toxicity. An experiment was carried out in 10 yearling sheep, 8 of which were exposed daily to oral doses of 25 or 50 mg./kg. of the technical equivalent. These levels represent the maximum safe and minimum toxic dosages, respectively. One group of 4 were limited to an estimated 50 to 75% of normal water consumption or 800 ml. daily. After 59 days it was concluded that water restriction has no significant effect on propazine toxicity to sheep. (I) Kerrville, Texas. IV-26-A

Effects of Methoxychlor and Malathion on Sheep. Conception rate of ewes and ability of rams to settle ewes was not affected by feeding 200 and 1000 ppm of methoxychlor or 270 and 1350 ppm of malathion in alfalfa pellets. Death losses of lambs did not appear to be affected by level of insecticide in dam's feed. Wool from lambs, reaching market weight, contained 0.2 to 5 ppm methoxychlor and 0.05 to 0.50 ppm malathion. Samples of edible meat contained from 0.05 to 0.16 ppm of methoxychlor. Methoxychlor was generally found in body fat stores and ranged from 0.22 to 1.82 from the low level methoxychlor group and from 3.0 to 14.2 ppm from the high methoxychlor group. (I) Beltsville, Maryland. IV-26-C

Structure of Teratogenic Agent Determined. The teratogenic agent in Veratrum californicum, responsible for cyclopan type malformations in lambs when maternally ingested on the 14th day of gestation, has been purified and found to be a steroidal alkaloid with a structural identity of 11-deoxojervine. The teratogenic agent has been given the name of "cyclopamine." (I) Logan, Utah. IV-26-D

Effect of DDT on Mink. Farm-raised mink may be susceptible to residues of DDT found in fish which is often a major diet component. Pure p,p' DDT was fed to mink for three generations. No deleterious effects were noted through the second generation. Results from the third generation are incomplete. Since this study was initiated, ARS scientists and others have determined that o,p' DDT has estrogenic activity in rats and mice. Technical grade DDT used in commercial spraying contains approximately 15-20% o,p' DDT and 80% p,p' DDT. Assays of the estrogenic activity of o,p' DDT in mink are currently being conducted. (I) Ithaca, New York. IV-28-G

Field Crops

Effects of Herbicides in Irrigation Water on Yields of Crops. In Washington, silvex and 2,4-D were applied to three crops in August at different concentrations in 2 acre-inches of irrigation water applied by furrow and sprinkler irrigation. Both herbicides caused some degree of injury to corn, soybeans, and sugarbeets when applied at 0.5 or 2.5 lb/A by furrow irrigation. However, the only significant yield reductions were by silvex at 2.5 lb/A (5.50 ppm) on sugarbeet tops and soybean seed. Neither herbicide caused visible injury or yield reduction at 0.1 lb/A (.22 ppm). (I) Prosser, Washington. IV-31-A

Effect of Fumigating Wheat on Flour Quality. A study has been completed of the effect of a number of fumigants on the baking quality of flour milled from stored wheat. The wheat was stored for three years with eight periodic fumigations with methylbromide, phosphine, or ethylene dichloride-carbon tetrachloride. Overall quality of wheat deteriorated during the course of

the study and was reflected in poor eating quality of the bread. Phosphine had a particularly adverse effect on the bread making qualities of wheat flour. Techniques and treatments for flour production may require modification should phosphine fumigation become more widely used. There was a consistent build up of inorganic bromide residue from 8 to 99 ppm, as a result of methylbromide fumigation. (I) Beltsville, Maryland. IV-321-C

Malathion Decomposition on Wheat. It is assumed that malathion decomposition in wheat is based on enzymatic breakdown. Total lipids were determined on varieties sensitive and nonsensitive to sprouting. Total lipids decreased in both varieties until ripening and further during sprouting. This line of investigation is promising, as differences in lipid metabolism between the 2 varieties have been shown. (P. L. 480) University of Helsinki, Helsinki, Finland. IV-321-C

White-Fringed Beetle Control. Field-collected adult white-fringed beetles were exposed to wheat treated with malathion at 8 ppm, with malathion-dichlorvos combinations at 8:1 and 8:2.5 ppm, and with dichlorvos at 1, 2.5, 4, and 6 ppm for various exposure period. Malathion at the rate of 8 ppm was not effective against the beetle. Dichlorvos applied at rates of 4 and 6 ppm, resulting in an actual deposit on the wheat of 3 to 4 ppm, was effective against the adult beetle and prevented oviposition in the grain. Dichlorvos residues on the wheat decreased to only trace amounts within 12 days after treatment. (I) Manhattan, Kansas. IV-321-C

Estrogenic Properties of Storage Molds are Studied Further. Five species of *Fusarium* were tested for the estrogen resorcylic acid lactone (RAL) in Indiana. Only *F. roseum* or *F. graminearum* were positive. Most of the RAL-positive isolates formed *Gibberella perithecia* and came from corn. After a 3 week incubation on autoclaved corn, RAL ranged from 1 to 314 ppm as detected by thin-layer chromatography. This procedure was more sensitive than a spectrophotometric procedure. (E-fg) Indiana Agr. Exp. Sta. IV-326-B

Effect of Relative Humidity on Inert Dusts. Preliminary evaluations showed that relative humidity influenced the wide range of efficacy of several inert dusts against the granary weevil. (P.L. 480) University of Zagreb, Zagreb, Yugoslavia. IV-326-C

Malathion on Shelled Corn. Data collected from samples of shelled corn stored in tobacco warehouses showed that malathion residues decreased at a faster rate in corn stored at shallow depths than in corn stored in upright bins. Malathion residues after 8 months averaged only 3.7 ppm in corn 4 to 5 feet deep, and 1.7 ppm on the surface. (I) Tifton, Georgia. IV-326-C

Effect of Atrazine on Mitochondria. Effects of atrazine on the growth of corn seedlings and mitochondria isolated from them were investigated. In vivo applications of 10 and 40 ppm 2 days after planting and 1.5 days before harvesting had no consistent effect on the fresh weight of the harvested plants nor on the oxygen consumption or P/O ratios of the mitochondria isolated from the etiolated shoots. In vitro treatment of the isolated mitochondria with 2 and 4 x 10⁻⁴ M concentrations of atrazine had no significant effect on their oxygen consumption or P/O ratios. (E-fg) Alabama Agr. Exp. Sta. IV-326-D

Pesticide Residues on Alfalfa. In green alfalfa residue studies, higher levels were found in leaves than in stems, and more in roots than in the above ground parts. Residues in leaves are not merely dissolved in the waxes but are incorporated in the leaf. Alfalfa residues are much higher in late summer than at any other season. (E-fg) Arizona Agr. Exp. Sta. IV-332-C

Disappearance of a Phosphoramidate Chemosterilant in the Boll Weevil. The cotton boll weevil, Anthonomus grandis (Boheman), was treated by topical application, tarsal contact, and injection with the chemosterilant N,N,N',N'-tetramethyl-p-piperidinophosphonic diamide. Gas chromatographic analysis of the residues remaining in or on the boll weevil at various times after treatment showed that the greater part of the residues has disappeared after 24 hrs., regardless of the method of treatment. The rate of disappearance of the parent compound from the males injected with 20 µg of the compound was extremely rapid; only 20 percent of the original dose remained 1 hr. after injection. (I) Fargo, North Dakota. IV-351-C

Removal of Pesticide Residues from Milk. Although several chlorinated hydrocarbon insecticides can be removed from milk fats by use of molecular distillation, other substances important to the flavor of milk fat are also removed simultaneously. These include low molecular weight fats (short-chain fatty acids) as well as methyl ketones, lactones and other flavors. (E-fg) Oregon Agr. Exp. Sta. IV-37-C

Mechanism by Which Herbicides Affect the Development and Sugar Content of Sugarcane. Research has advanced in two general areas: Biochemical effects of Diuron when given to cane under varying conditions of variety, soil and nitrate supply (sand culture). Growth and ripening effects of pyrimidine and purine analogs. Encouraging results were obtained with 6-azauracil in controlling sugarcane growth. The analog is readily translocated from foliage to meristematic areas where it disrupts normal initiation of vegetative tissues. As little as 0.005 percent solution is effective as a foliar spray. Sugars and protein accumulate while general enzyme activity is vastly retarded. The growth effect has been studied under conditions of gibberellic acid and nitrate growth stimuli. (E-fg) Puerto Rico Agr. Exp. Sta. IV-371-D

Horticultural Crops

Trace Levels in Fruits and Vegetables. DDT in vegetables is partially converted to DDD and other less toxic substances by cooking. Extent of conversion varies with cooking time, notably during the first 6 minutes. Contact with glass or iron cooking utensils results in marked differences in the percent degradation. Thus a 12 minute boil in containers of glass and of iron gave 27% and 68% reduction, respectively. Peeling and coring favors a lowered content in organo-chlorine pesticide residues in apples, and cooking gives a further reduction. While buffing was more effective in removing parathion residues from peaches than from apples, peeling reduced the organophosphate residues by 90% in both fruits. Only 50% reduction of organophosphates in apples and peaches resulted from 10 hour exposure to ultraviolet irradiation. Improvements have been developed in analytical methods for pesticides based on better cleanup procedures and more sensitive detection devices. (E-fg) Missouri Agri. Exp. Sta. IV-41-A

Insecticides Removed By Household Preparation Practices. The effects of home and commercial food preparation practices in removing insecticides present near tolerance level on a variety of vegetables were studied. DDT, carbaryl, and malathion were in general greatly reduced, peeling, where applicable, removed residues almost completely. Parathion was used on spinach and broccoli and in both instances was difficult to remove. (E) Washington, D. C. and Berkeley, California. IV-42-C

PCNB Reduces Browning In Potatoes. Potatoes grown in pentachloronitrobenzene (PCNB) treated soil were lower in free tyrosine content and showed less enzymatic browning than did control potatoes. This change in composition and quality caused by pesticide use is a beneficial one in that darkening of potatoes due to enzymatic browning is a problem in home and institutional food preparation. The PCNB had an adverse affect on flavor according to a small minority of taste panel members who apparently have an extremely low tolerance for PCNB. (I) Beltsville, Maryland. IV-421-B

Pesticide Residues on Spinach. The analysis of phorate and disulfoton in soil treated for the control of the green peach aphid on spinach has been completed and the data is in the process of being analyzed. Generally, phorate was degraded faster than disulfoton in the soil, and the degradation of both was faster under warmer conditions. Oxidative metabolites of both insecticides were present in the soil. Most of the residues present consisted of the sulfone derivative of the parent compounds. Only minute amounts of the parent compounds and their oxygen analogs were present in the soil. Analysis of dimethoate on winter spinach has been completed and the results are being analyzed. (E-fg) Maryland Agri. Exp. Sta. IV-427-C

Persistence of Pesticides in Cranberry Soils. Parathion applied to cranberry bogs at the rate of 1 pound per acre for the control of fruit-worm and other pests was found to be undetectable in drainage waters from the bog if drainage was stopped for 48 hours following treatment. Similar studies of dieldrin showed that only minute amounts moved downstream in drainage ditches. Dichlobenil persistence in cranberry soils has been shown both by chemical analysis and bioassay. Impounding of drainage waters for one day following treatment of a cranberry bog with dichlobenil appeared to prevent escape of the chemical downstream. (E-fg) Massachusetts Agr. Exp. Sta. IV-452-A

Forests

Uptake of Benzene Hexachloride. Levels of accumulation of benzene hexachloride (BHC) have been determined in leaves, stems, and roots of loblolly pine and sweetgum seedlings. Microautoradiography has indicated the sites of accumulation within these organs. Almost all of the gamma isomer of BHC is strongly absorbed to the cell walls of all internal tissues, and a very pronounced concentration gradient exists from the point of application to the distal region of plant tissues. None or very little BHC is actively accumulated by living cells. (E) University of Georgia, Athens, Georgia. IV-5-A

Forest Environment Not Damaged by Sevin. The insecticide Sevin was applied by a helicopter at the rate of 1 pound per acre to an area near Syracuse, N.Y. Coverage was excellent. Water samples taken immediately and daily thereafter contained no detectable Sevin or its derivative. Soil tests were also negative as were Tricoptera (one of the aquatic insects) and leaf extracts tests. The preliminary conclusion is that the very short residual effect of Sevin creates little or no polluting effect on the soil and aquatic biome. At the same time, the lack of residual effect suggests that Sevin is a relatively ineffective insecticide. (E) Syracuse, N. Y. IV-5-C

Long-Term Movement of DDT in Soil. The use of chlorinated hydrocarbon insecticides for soil treatment to prevent termite attack has invoked some concern regarding possible contamination of wells, ponds, and streams. Tests in Mississippi indicate that for DDT at least this concern may not be well founded. After 20 years in field plots in Rumford sandy loam soil, technical DDT subjected to over 100 feet of rainfall has not moved more than 12 inches below where it was originally placed. Results of analyses also were negative in the areas of 4 to 28 inches deep and 20 inches or more away from the treated soil. Analyses also indicate that the only movement of DDT on the soil surface was by sheet erosion and that most of the DDT in this circumstance was converted to the low toxicity DDE. (I) Gulfport, Mississippi. IV-5-C

Residual Activity of Phorate in Loblolly Pine Seedlings. Root absorption and translocation of phorate into old needles, buds, and new terminal shoots of loblolly pine seedlings was investigated, using application rates of 2.60, 5.25, and 10.50 grams per plant. Movement into all of the plant parts was rapid and uniform, so that 100 percent mortality of a pine aphid (Cinara watsoni) and the pales weevil (Hylobius pales) occurred from 15 days, the first sample observation, through 300 days after treatment. Complete aphid and weevil mortality was obtained from roots and stems at the lowest dosage level 480 days following treatment. New terminal growth and old needles were the first plant parts to show a decrease in insect kill, and this occurred in all treatments 300 to 360 days after application. No phytotoxicity was evident in any of the seedlings. (I) Raleigh-Durham, North Carolina.

IV-5-C

Zectran Residue. Determinations of residues on Douglas-fir and five common browse plants of Zectran applied by aircraft at the rate of 0.15 lb. per acre showed that residue levels dropped rapidly on most of the plants within one day after treatment. The amount remaining after one week was negligible on all except Fragaria and Ceanothus species, and decreased to 0.4 and 0.2 ppm in these plants respectively after four weeks. (I) Berkeley, California.

IV-5-C

Forest Herbicides Will Not Seriously Contaminate Adjacent Waters. A review of research findings indicates that many herbicides and their carriers, when used in a responsible manner, can be employed in forest vegetation control with minimum impact on water quality. These findings predominate: (1) Nearly all residues found in streamwater results from direct application of sprayed materials to the water surface, (2) the maximum concentration of herbicide residue in water is a function of the amount of live stream included in the sprayed unit, the ratio of the surface area of the stream to its volume of flow, and the degree of interception afforded by overhanging vegetation, and (3) the length of persistence of chemical residues is a function of the hydrologic nature of the area. (I) Corvallis, Oregon.

IV-5-D

TARGET V

TO STUDY ECONOMIC ASPECTS OF PEST CONTROL AND ITS IMPACT ON THE ENVIRONMENT;
DETERMINE THE SUPPLY, REQUIREMENTS, AND USE OF PESTICIDES;
AND GIVE ASSISTANCE TO CONTROL AGENCIES
AND INDUSTRIES IN EMERGENCIES

Aggregate Economic Analysis of the Productivity of Chemical Pesticides.

Transformed data from the ERS 1964 Pesticide Uses Survey were used in computing some preliminary regressions to relate pesticide input to output for each of the types of farming regions in the United States. (E) Columbia, Missouri.

Economic Analysis of Water Pollution and Other Agricultural Wastes. Cooperative research continues with Iowa State University. Physical science research has established that sediment movement is a major transmission mechanism for movement of pollutants, particularly agricultural chemicals and plant nutrients, from land source areas into water supplies. Major emphasis is given to the identification of these and other adverse effects from sediment movement and the economic assessment of alternative methods for reduction of adverse impacts. (I and E) Ames, Iowa; and Washington, D.C.

Economic Principles of Pest Management. The economics associated with controlling insects will be included in a book entitled "Principles of Insect Pest Management and Control" to be published by the National Academy of Science. (I) East Lansing, Michigan; and Washington, D.C.

Expenditures for Custom Pesticide Services. Survey data show that because of the specialized nature of agricultural chemicals, farmers use custom pesticide services extensively. Farmers in the 48 States spent about \$173 million for custom pesticide services, including cost of application and materials in 1964. Nearly \$172 million was spent for controlling crop pests and slightly less than \$2 million for controlling livestock pests. About one-third of those using any pesticides on crops in 1964 used some custom services. The cost of custom applied pesticide materials alone was \$115 million or one-fourth of all pesticides used by farmers in 1964. (I) Washington, D.C.

Pesticide Expenditures for Crops, Livestock and Other Selected Uses.

Results from a nationwide survey show that for pesticide materials alone, farmers spent an estimated \$479 million in 1964 -- \$424 million for crops, \$31 million for treating livestock, \$8 million for rodent control, and \$16 million for treatment of land not in crop production. Among individual crops, more money was spent -- \$114 million -- for pesticides used on cotton than any other crop. Over 90 percent of the acreage of apples, other deciduous fruits, and tobacco were treated. Almost 60 percent of the corn, the most widely grown crop, was treated. Animals were treated during the year by almost three-fourths of the farmers with livestock, and over half of this expenditure was associated with beef cattle. (I) Washington, D.C.

Extent and Cost of Weed Control with Herbicides and an Evaluation of Important Weeds. A cooperative survey conducted jointly by the Agricultural Research Service, Federal Extension Service, and the Economic Research Service show that the use of herbicides in the United States continues to increase. Weed scientists in the 50 States estimated that nearly 84 million acres were treated with postemergence herbicides in 1965 as compared with 55 million in 1962 and 49 million in 1959. Also, 36 million acres were treated with preemergence herbicides in 1965 as compared with 15 million in 1962 and 4 million in 1959. Some of these acres were treated with both preemergence and postemergence materials. (I) Washington, D.C.

Extent of Farm Pesticide Use on Crops. Estimates based on a nationwide survey of pesticide use in 1966 show that on crops alone over half of the U.S. farmers use weed, insect, or disease control chemicals. About 37 percent of the farmers growing crops used herbicides, 29 percent used insecticides, 4 percent used fungicides, and 8 percent used other pesticides (including defoliants, desiccants, growth regulators, miticides and rodenticides). Herbicides were applied on over half of the corn, cotton, rice, peanut, and potato acreage. Insecticides were used on over 50 percent of the acres of peanuts, fruits, and vegetables. Disease control chemicals were used on more than 70 percent of the citrus and apple acres and on a large share of the other fruit, peanut, and vegetable acreage. (I) Washington, D.C.

Herbicides Used on Corn, Grain Sorghum, and Soybeans in Nebraska. Data from 13 counties show that herbicide use increased significantly between 1964 and 1966. The cost of herbicides per acre varied considerably between 1964 and 1966, especially for new herbicides and those used on a small percentage of the acreage. In counties where farmers were just beginning to use herbicides the application rate tended to be higher than in counties where herbicides had been used for several years. (I) Lincoln, Nebraska.

Pesticide Use on Forest lands. Nationwide use of pesticides for control of forest insects and diseases on Forest Service-managed lands and on cooperative projects with States was reported and summarized. (I) Washington, D.C.

Market and Demand for Herbicides. This study will include an analysis of the factors related to the use of herbicides. This information will then be used to estimate the market for herbicides in 1980. (I) East Lansing, Michigan.

Structure of the Pesticide Industry. Nearly all the basic pesticide chemicals were produced by 106 firms operating 169 plants in 1964. More than half of the plants were located in six States. A number of these firms are among the largest businesses in the country and are well diversified. The basic chemicals are blended into a finished product by approximately 1,600 formulating plants throughout the 48 contiguous States. Most of these plants are relatively low-cost installations with simple mixing and blending equipment. The finished product is marketed to farmers -- 40 percent; institutional, industrial, and residential users -- 40 percent; and exports -- 20 percent. (I) Washington, D.C.

Simulation Programming Techniques to Evaluate Red Scale on Citrus. Basic data (published and unpublished) were collected on the biologies of the red scale and the parasites. It has been determined that a pest-predator model using the "micro" approach is not feasible because of the lack of compatible data. Work has begun on the building of a "macro" pest-predator model. (E) Davis, California.

Evaluation of the Consequences of Relevant Spray Strategies in the Control of Brown Rot on Peaches. Decision rules for pesticide use which will increase expected payoffs for the individual firms will be developed from climatological rain frequencies and rain forecasts, and from subjective probabilities of various intensities of brown-rot infestations. (E) Davis, California.

Production and Sales. United States production of pesticides continues to grow to meet the rising use by U.S. consumers and the vigorous export demand. Production figures available are limited mostly to synthetic organic pesticides. As these chemicals constitute all pesticides except a few of inorganic and botanical origin, the statistics for synthetic organic pesticides provide a real indication of overall trends. The production of synthetic organic pesticides increased more than 37 percent over the five-year period 1963-67 ranging from 2.5 percent in 1964 to 15.5 percent in 1966. The annual growth rate in total sales value for this period averaged about 15 percent. The value of synthetic organic pesticides produced in 1967 was 26 percent and of producers' sales 35 percent above 1966.

Consumption. The domestic disappearance of pesticides at the manufacturers' level can be calculated for only a few chemicals because so many are proprietary products. DDT continued its general decline from the peak crop year of 1959 when domestic use reached a record high of almost 79 million pounds. Consumption for the 1967 crop year was down to around

40 million pounds. Total copper sulfate disappearance declined 18 percent from the 1966 crop year and was also down somewhat from the 1965 crop year, but still higher than for any other crop year since 1952. Consumption of the aldrin-toxaphene group of insecticides was essentially the same in the 1967 crop year as in the previous crop year which was the highest of all time.

Exports. U.S. pesticide exports in 1967 were valued at nearly \$196 million, 13 percent above the previous year. Insecticides comprised 59 percent, herbicides 23, fungicides 11, fumigants 2.3, and rodenticides 0.2 percent. Organophosphorus insecticides alone amounted to 23 percent of all pesticides exported in 1967. DDT amounted to 8 and polychlor insecticides other than DDT to 14 percent. Notable shifts in 1967 were the lower DDT exports and the large increases in exports of other polychlor insecticides (technical), organophosphorus insecticides (technical), and organic herbicides (technical and preparations) except 2,4-D and 2,4,5-T. Military shipments of the latter are not classed as exports. Over 27 percent of the export value went to countries in North America outside the United States. Shipments to Europe in 1967 increased 31 percent over 1966 and accounted for 26 percent of the total pesticide export value. Canada, Egypt, Japan, and France in that order were the four leading recipients in value of pesticides from the United States in 1967. The United States shipped \$3.4 million worth of pesticides to eastern European countries in 1967, up 46 percent from the previous year. U.S.S.R., Rumania, and Yugoslavia in that order accounted for over 90 percent of this.

Imports. The value of U.S. pesticide imports in 1967, insofar as reported, was \$16.3 million, primarily benzenoid organic chemicals and botanical products. The benzenoid pesticide imports valued at \$8.9 million, were up 43 percent from the previous year. Netherlands and France contributed most heavily to the increase. The United Kingdom and West Germany also added to the rise in U.S. imports but their combined share of total imports of benzenoids fell in 1967 to 41 percent from 52 percent in 1966. Herbicides accounted for most of the 1967 benzenoid imports. Together 2,4-D, paraquat, and 2,4-DP made up more than three-fourths of these imports. Imports of the major botanical products (pyrethrum, rotenone-containing materials, nicotine, and strychnine) in 1967 were valued at \$7.4 million, down 12 percent from 1966.

Fungicides. Producers' sales of synthetic organic fungicides in 1967 reached \$56 million, up about 6 percent from 1966. However, the fungicide dollar share of the pesticide market continued to decline to only 7.2 percent of total pesticide sales. The volume share declined for the first time since 1964. The United States exported \$21 million worth of fungicides in 1967, 6 percent below the previous year. A large share of the decrease resulted from the reduction in shipments of technical inorganic fungicides.

Creosote. Creosote, used alone or in combination with other materials, was down 4 percent from 1966 after increases of 6 to 7 percent in each of the previous three years. Creosote accounted for 61 percent of all liquid

preservatives used in 1967. Creosote and its solutions are still used to treat the majority of fence posts and piling and approximately half the poles treated.

Pentachlorophenol (PCP). Production of PCP in 1967 amounted to 44 million pounds, up 2 percent from 1966. Production had been rising about 8 percent annually since 1963. The wood-preserving industry in 1967 used 30 million pounds, nearly double this use five years ago. Pentachlorophenol has made its largest gains in pole and post treatments. It has displaced an estimated 50 million gallons of creosote and its solutions. Use of pentachlorophenol by this industry rose 29 percent in 1966, but then dropped nearly 5 percent in 1967. Pentachlorophenol accounted for about two-thirds of the total preservative solids. The remaining one-third was waterborne materials, which decreased 3.7 percent from the previous year. Some additional PCP is used in the United States by individuals and groups other than the wood-preserving industry.

Mercury. Mercury products have a wide variety of limited applications as pesticides. These uses are not only in agriculture, particularly in seed treatment materials, but in industry, particularly the paper and pulp industry and the paint industry. In 1967, approximately 797,000 pounds, or 15 percent of the total U.S. mercury consumption, was used for pesticide manufacture. About 59 percent of this was in mildew-proofing paint, 36 in agriculture, 4 in paper and pulp, and 1 percent in antifouling paint.

Copper sulfate. Copper sulfate is still widely used as a fungicide. It apparently has no completely effective substitute in the control of black pod disease of cocoa in the tropics, brown rot of lemons, and late blight of potatoes and tomatoes. However, it has been replaced as an effective control measure for apple scab and apple blotch. Appreciable amounts are used to correct soil deficiencies of copper, especially for citrus, and as a supplement in livestock nutrition. Shipments for use in agriculture in 1967 continued to decline, falling 18 percent from 1966 to a level lower than any year since 1960.

Herbicides. The demand for herbicides continued in 1967 to increase more rapidly than that for either fungicides or insecticides. Herbicide sales have risen 271 percent in value since 1963, which is more than double the 113 percent increase for all pesticides together. The dollar gap between insecticides and herbicides has been closing rapidly in recent years and in 1967, for the first time, herbicide sales exceeded insecticide sales in the United States. Herbicide sales in 1967 reached \$430 million, nearly 67 percent over 1966, and accounted for nearly 55 percent of the value of all sales of synthetic organic pesticides. This level was due in large part to the faster rise in average value per pound of herbicides over other pesticides. The United States exported herbicides in 1967 valued at nearly \$46 million, up 23 percent over the previous year. The increase was largely in herbicide formulations.

2,4-D and 2,4,5-T. United States production of 2,4-D continued its rapid climb in 1967 to set a new record, as it has each year since 1962. Production in 1967 was 77 million pounds, up about 13 percent from 1966 and more than 79 percent from 1962 at the beginning of the present upward trend. Production in the first six months of 1968 was 40,391,000 pounds, up 1.8 percent over the like period last year. 2,4-D which is applied extensively in crop cultivation, continues to be available to domestic users, although substantial quantities are purchased by the military for use in Vietnam. United States production of 2,4,5-T in 1967 was nearly 15 million pounds, down 6 percent from the previous year, highest on record, but nearly four times the production in 1958. Production rose steadily from 1958 to 1966. Production through June 1968 amounted to 9,298,000 pounds, up 25 percent from the first six months a year ago. Despite heavy government buying of both 2,4-D and 2,4,5-T no serious shortages for civilian use have occurred. In many cases, adequate substitutes were available especially for industrial use. Control of brush on rangeland may have fallen off from lack of sufficient supplies of 2,4,5-T. Exports of 2,4-D and 2,4,5-T continue to decline and in 1967 amounted to only 4,410,000 pounds, down almost 19 percent from 1966. For the first six months of 1968 exports were 737,000 pounds, down nearly 141 percent from the like period last year. Probably all of this was 2,4-D. Government requirements were responsible for this sharp drop in exports.

Sodium chlorate. This chemical has been in use for over forty years as a weed killer along railroad rights-of-way. Fast acting on top growth, it is also used as a defoliant. Newer herbicides have tended to reduce the market for sodium chlorate herbicides during recent years. The estimated volume of sodium chlorate used as a herbicide and defoliant in 1967 was 30 million pounds compared with 36 million in 1955. An estimated 11 percent of the total U.S. consumption of sodium chlorate has gone for weed control and defoliation whereas about 35 percent was so used in 1955. A large proportion of U.S. production goes for manufacture of the chlorate used in the paper industry.

Herbicidal oils. Herbicidal oils have been commercially significant for weed killing purposes for many years. Their first uses were in non-crop areas such as fence rows, rights-of-way, firebreaks, and drainage ditches. Their first use in crops was probably about 1942 when low-boiling fractions were found satisfactory for weed control in carrots and later other vegetables. They have shown a rapid growth from a trade estimate of \$600,000 in 1942, to \$9 million in 1962. They account for a fairly steady 3 percent of the herbicide market.

Insecticides. While the rate of growth is not as spectacular as for herbicides, insecticide sales continue upward. Manufacturers' sales of synthetic organic insecticides in 1967 reached \$301 million, 10 percent above the previous year. However, their share of total pesticide sales dropped to only 38 percent of the total value, falling behind herbicide

sales for the first time. The United States exported insecticides in 1967 valued at \$115 million, up about 14 percent over the previous year. The rise in insecticide exports resulted largely from the increase in exports of technical polychlors and organophosphates.

DDT. DDT is still the insecticide most used worldwide despite the trend away from persistent insecticides. However, the over-all demand for DDT, both at home and abroad, has been on the decline. Production during 1967 was 103 million pounds, down 27.4 percent from 1966. Production in the first six months of 1968 was nearly 71 million pounds, up 26.4 percent from the first six months of last year. Exports during 1967 came to 82 million pounds (technical basis), down 10 percent from the year before. Exports during the first six months of 1968 were 46 million pounds, up 1.6 percent from the same period in 1967. Over half of all DDT exported is in the form of 75 percent wettable powder, most of which goes for control of malaria mosquitoes. In 1967, five countries -- India, Thailand, Brazil, Nepal, and Mexico in that order -- together received over two-thirds of the export tonnage of the 75 percent DDT formulation.

Benzene hexachloride (BHC). Benzene hexachloride production peaked in 1951 at about 117 million pounds, but declined to less than 7 million pounds by 1963. Production figures since then have not been published by the Tariff Commission to avoid revealing operations of individual producers. Cotton has been the largest market for BHC. The introduction of newer insecticides, especially the organophosphorus compounds and the switch to sprays have contributed to the decline of benzene hexachloride. The present use of benzene hexachloride is primarily as a high-gamma material in dusts and in the manufacture of lindane, the 99 percent purified gamma isomer, used in specialty applications. Some benzene hexachloride is exported for control of insects affecting cotton and certain other crops.

Cyclodienes. The aldrin-toxaphene (or cyclodiene) group of chlorinated hydrocarbon pesticides has had increased usage over the years. Average annual U.S. consumption for the five years ending September 30, 1967 was 82 million pounds, up 73 percent from the similar five-year period which ended in 1957. Average annual production for the last five calendar years was 116 million pounds, up 8 percent from the five-year period ending with 1957. Production in 1967 was 120 million pounds, down about 8.5 percent from 1966.

The parathions. Methyl parathion is probably the insecticide most used currently for controlling insects on cotton. It is particularly in demand where the bollworm and the tobacco budworm have shown resistance to the chlorinated hydrocarbons such as DDT, toxaphene, and endrin. Parathion (sometimes called ethyl parathion) is also used to control a number of cotton insect pests, including leafhoppers, brown cotton leafworms, aphids, and spider mites. It is often used in combination with methyl parathion. Production of both parathion and methyl parathion has increased generally

since 1957, first year that production figures for methyl parathion were available. The rate of growth has been surprisingly parallel. Methyl parathion production in 1966 was nearly 36 million pounds, up 122 percent from 1962; parathion production in 1966 was slightly over 19 million pounds, up 121 percent from 1962.

Pyrethrum. Pyrethrum continued in 1967 to be imported as both the dried flower heads and the extract containing 20 percent pyrethrins. Most U.S. processors depend upon these imports of extract since they no longer have extraction facilities of their own. The total value of pyrethrum imports (flowers and extract) in 1967 amounted to \$6,825,000, down about 10 percent from the previous year. About 76 percent of the dollar value of the imports came from countries in Africa. Imports of pyrethrum extract in 1967 amounted to 596,771 pounds, down nearly 18 percent from 1966. The combined imports from Kenya and Tanzania accounted for 72 percent of the total volume, almost the same proportion as in 1966. Ecuador was in third place with 18 percent of the U.S. extract imports in 1967. Flower imports in 1967 amounted to 1,890,292 pounds, up 18 percent from the previous year. Nearly 72 percent came from Kenya and Tanzania, about the same proportion as for the extract. These two countries furnished no flowers in 1965. Burundi and Rwanda, leading shipper of flowers in 1966, was in third place in 1967.

Cube root. Total imports (whole and powdered material) by the United States amounted to 2,825,000 pounds in 1967, down 30 percent from 1966, but otherwise the highest since 1963. Peru furnished 87 percent of the root imported in 1967, whereas all imports in 1966 came from Peru. In addition to Peru, some whole root came from Venezuela and some powdered material, probably derris, came from India.

Nicotine. Imports of nicotine and its compounds by the United States amounted to about 78,000 pounds in 1967, valued at about \$96,000. This was only about one-third the volume imported in 1966 but nearly two-thirds the value. The United Kingdom continued to lead as a supplier with 48 percent, while Hungary and Bulgaria each supplied 22 percent. None came from France or Switzerland, which together had provided 6 percent the previous year.

Basic data for emergency planning. The 1968 Pesticide Review was printed and distributed in December to interested government agencies (Federal and State), industrial and related organizations, and individuals. The primary objective of this report is to assemble information needed in planning for a national emergency. The information forms the basis for estimating total U.S. pesticide requirements. It contains available data, both general and specific, on production, sales, foreign trade, and domestic consumption. The report is used by government agencies concerned with chemicals, the chemical industry generally, engineering firms, advertising agencies, financial institutions, trade journals, and consultants. Numerous requests for it are received from abroad.

TARGET VI

TO CONTROL PESTS AND PROTECT THE ENVIRONMENT DURING AND AFTER CONTROL OPERATIONS

General

Domestic Plant Quarantines Revised. All Federal quarantines were revised making it possible for parallel Federal and State quarantine action to be applied. In addition, quarantines were rewritten to simplify and clarify their content, so that cooperators and affected public would more readily understand the provisions of the quarantines. Revisions were made in regulated areas in States previously infested for witchweed, imported fire ant, white-fringed beetle, pink bollworm, and European chafer. Following public hearings in Chicago, portions of the States of Illinois, Tennessee and Michigan were added to the Japanese beetle quarantine; Pennsylvania to the gypsy moth quarantine; and Florida, Indiana, and Louisiana to the soybean cyst nematode quarantine. (I) and (E) Nationwide. VI-1-A

Foreign Plant Pests New to the United States Detected. A total of 13 insects and related pests, previously not known to occur in the United States, were reported during fiscal year 1968. The most important of these were a grass webworm on Oahu Island, Hawaii; a pistachio seed chalcid in Butte County, California; and a slug in Cameron County, Texas. Followup surveys show the grass webworm to be widespread in Hawaii; however, the seed chalcid is still confined to a local area of California and an eradication program against it is underway. Detection surveys for the slug indicate that the pest is confined to southern Texas. The objective of the detection program is to find pests early and to report them promptly so that they can be eradicated quickly. This eliminates the need for use of pesticides against them over wide areas as they continue to spread. (I) and (E) Nationwide. VI-1-A

Guarding Against Pest Introduction. Due to the increasing number of pest introductions found at military installations in the United States, a selected turf treatment program has been initiated at important military installations within the conterminous United States. These treatments have been reviewed and approved by the Federal Committee on Pest Control and the Armed Forces Pest Control Board. Such treatments will provide additional safeguards

against the introduction of dangerous foreign plant pests. (I) and (E) Nationwide. VI-1-A

Assistance to Soil and Water Conservation Districts. As part of its technical assistance to soil and water conservation districts in the various States, the Department of Agriculture upon request continued to furnish information on pesticides, fungicides, and herbicides in accord with U.S. Department of Health, Education, and Welfare guidelines for use in the management of resource conservation and development programs, including fish farms, woodland, and range. This information was furnished to individuals or groups cooperating with the local districts. (I) Washington, D.C. and field locations. VI-1-A

Cooperative Survey Provides Current Insect Information. The main objective of the national insect pest survey is to assist farmers in protecting their crops before damage becomes widespread. The survey is supported by more than 1,200 volunteer cooperators who make observations and evaluations of pest activity as a part of their regular field work. In addition, cooperative agreements provide for survey programs in 33 States. Information on current conditions is issued in the "Cooperative Economic Insect Report" and sent to 4,000 readers each week. (I) and (E) Nationwide. VI-1-C

Eradication Concept Under Test in Imported Fire Ant Program. Large-scale tests designed to test the present control practices as an eradication procedure were initiated in Georgia, South Carolina, and Florida. Assessment of the number of properly timed mirex bait applications to achieve eradication is the primary objective. A joint research-methods development effort on a complete study of the biology and ecology of the pest is underway. Four universities are contributing to the overall research program through research contracts. (I) Gulfport, Miss., Gainesville, Fla. (E) Louisiana State University, Fla. University, Georgia University, Mississippi State University. VI-1-C

Imported Fire Ant Controlled on Large Acreage with Mirex Bait. The imported fire ant now infests large areas of nine southern States. Control or eradication treatments, using mirex bait, were applied to 14.2 million acres in these States during the year. Eradication treatments were limited to isolated or peripheral infestations. Electronic guidance of aircraft was used in almost every instance where eradication was the goal. (I) and (E) southern States. VI-1-C

Spread of Japanese Beetle to the West Prevented. With the recent finding of this beetle in Alabama, infestations now extend from that State to Maine, and west to Missouri. Spread west of the Mississippi River has been prevented through an effective containment program, however. To detect spread of the Japanese beetle to noninfested areas, over 50,000 traps were used during the year. To control incipient infestations in outlying areas, 13,232 acres were treated. The pest was first found in the United States at Riverton, N. J., in 1916. It attacks more than 300 different kinds of ornamental and agricultural plants. (I) and (E) Nationwide. VI-1-C

Noxious Weeds on Farmland. Under the USDA Agricultural Conservation Program (ACP) administered with State and County Committees, Federal cost-sharing is offered to farmers for controlling perennial weeds, as well as biennial weeds in permanent vegetative cover, designated as noxious by the State ACP development group. This practice is applicable only in areas where weed control measures will be carried out on an organized basis.

Under the 1967 and 1968 ACP 634,470 and 701,895 acres, respectively, were treated. VI-1-D

Field Crops

Cereal Leaf Beetle Being Kept Out of Major Grain Areas. This serious pest of small grains was first found in the United States in southeast Michigan in 1962. Infestations now occur throughout Ohio; in most of Indiana and lower Michigan; in several counties of Illinois, Pennsylvania, and Kentucky, and two counties of West Virginia. West Virginia and Kentucky were found infested for the first time in the spring of 1968. The program goal is to delay the spread of the pest into the major grain-producing States. This has been successfully accomplished through uniform State quarantines, and control treatments along the western periphery of the infested area. In 1968, 413,000 acres were treated in Illinois with ultra-low volume malathion. (I) and (E) Central and Eastern States. VI-32-C

Cereal Leaf Beetle Parasites Established. Following the 1967 release of about 300,000 of the foreign egg parasite Anaphes flavipes in Michigan and Indiana, recoveries were made in 1968. In addition one or more species of Trichogramma are apparently well established in limited areas as an effective egg parasite. Progress is being made toward mass rearing these species for subsequent colonization. (I) Niles, Michigan, (E) Purdue University, Michigan State University. VI-32-C

Witchweed Contained in the Carolinas. Witchweed, a parasitic plant which attacks roots of corn, sorghum, sugarcane, and other grasses, was discovered in North Carolina and South Carolina in 1956. Eradicative herbicidal treatments have greatly reduced the incidence of the weed and the rate of spread. Over 493,000 aggregate acres of infested cropland were treated with 2,4-D during the year. Witchweed has been found in only 35 counties of the two States. That no new counties have been found infested in the past three years testifies to the success of the control and regulatory programs. Spread of this weed pest to principal corn, sorghum, and sugarcane areas would require costly and extensive herbicide applications. (I) and (E) North Carolina, South Carolina. VI-32-D

Grasshopper Control Needed on Less Acreage. Earlier predictions of lighter grasshopper infestations during 1968 proved accurate. During the 1968 season only 850,000 acres of rangeland required treatment. This figure is considerably below acreage treated in prior years of heavy populations. (I) and (E) western States. VI-33-C

Competitive Brush on Range and Pasture. Under the USDA Agricultural Conservation Program (ACP) administered with State and County Committees, Federal cost-sharing is offered to farmers for controlling competitive shrubs to permit growth of adequate desirable vegetative cover on range or pastureland.

Under the 1967 and 1968 ACP 2,064,333 and 1,910,894 acres, respectively, were treated by chemical and mechanical methods VI-33-G

Army Cutworm Required Control on Reseeded Grasslands. Severe infestations of army cutworm occurred in reseeded grasslands of Idaho in 1968. More than 200,000 acres were infested and chemical controls were applied to 12,000 acres where population counts ranged from 54 to 72 per square yard. Carbaryl applied by air at the rate of 1.6 pounds per acre provided good control and averted damage to adjacent grass plantings. (I) and (E) Idaho. VI-331-C

European Chafer Still Contained in Northeastern States. European chafer was first recorded in North America when grubs were collected in Wayne County, New York, in May 1940. Since then, this scarab has been found in 36 additional counties in New York, three counties in New Jersey, two in Connecticut, one in West Virginia, seven in Pennsylvania, four in Massachusetts, and two counties in Ohio. The West Virginia infestation was eradicated. In fiscal year 1968, the chafer was found for the first time in Chautauqua, Steuben, Tioga, Ulster, and Orange Counties, New York; and Lycoming County, Pennsylvania. Soil treatment was applied to 572 acres in Massachusetts, 982 in New Jersey, and 2,465 in Ohio. (I) and (E) N.Y., Pa., Ohio, Conn., Mass. VI-331-C

Grass Bugs Becoming Problem on Reseeded Grasslands. Grass bugs, principally of the genus Labops, have become a problem on reseeded grasslands in some areas of western States in recent years. Ultralow volume applications of malathion were applied to 5,184 acres of reseeded grasslands in the Dixie National Forest, Utah, to control the insects in 1968. Tests to determine optimum rate of application were also carried out in conjunction with this treatment. Technical malathion applied at eight ounces per acre gave excellent control. Post-treatment counts showed less than one bug per square foot as opposed to as many as 100 prior to treatment. (I) Utah. VI-331-C

Soybean Cyst Nematode Found in New Areas. This pest of soybeans now occurs in 11 States, being reported for the first time from Florida in September 1967. The nematode was first found in this country in North Carolina in 1954. The program against the pest is designed to prevent spread until resistant soybean varieties or effective controls can be developed. Excellent progress has been made in the development of resistant varieties. This is encouraging since the pest is being found in increasingly large areas of the Mississippi Valley. (I) and (E) South and Midwest. VI-351-C

Boll Weevil Spread to Western States Halted. The westward movement of the boll weevil on the Texas High Plains has been stopped by an intensive cooperative effort which began in 1964. During the 1967 control season ultra-low volume malathion was applied by aircraft to 501,000 acres of cotton in the Texas High Plains area above and below the Cap Rock. The success of this program has minimized the threat of spread of the serious pest to Arizona, California, and New Mexico where 25 percent of the nation's cotton is grown. Absence of the weevil in these areas precludes the need for growers to use large volumes of pesticide for yearly weevil control. (I) and (E) Lubbock, Texas. VI-351-C

Boll Weevil Trap Shows Promise for Control. A stickyboard trap baited with live male boll weevils was evaluated as a means of detecting migration and field populations of weevils. The trap was not effective during the growing season when fruiting cotton was more attractive. It was highly effective in fall for detecting migrating populations and in early spring for weevils emerging from hibernation quarters. This trap shows promise as a control measure when directed at the overwintering population in the spring. (I) and (E) State College, Miss., Texas, New Mexico, Arizona, Mexico. VI-351-C

Pink Bollworm Sterile Moth Program Launched. A mass-rearing production facility was placed in operation at Brownsville, Texas. Approximately 1/2 million sterile pink bollworm moths were shipped from this facility early in the season and released in the San Joaquin Valley in California to combat the infestation found there in 1967. Production levels of 8-9 million sterile moths for the season were anticipated. (I) and (E) Brownsville, Texas; California. VI-351-C

Horticultural Crops

Surveillance of Foreign Fruit Flies. The detection Program for the Mediterranean, oriental, melon, and other important foreign fruit flies, was continued in the southern United States and Mexico. A total of 21,000 traps was maintained in these areas. There were no catches of important foreign fruit flies. The last fruit fly outbreak occurred in Texas in 1966. The species involved was the Mediterranean fruit fly. Prompt detection allowed successful eradication in 44 days. This eliminated the need for insecticidal control on a continuing basis over a large area vulnerable to invasion by the pest. (I) and (E) Southern and Western States, Mexico. VI-41-C

Golden Nematode Found in New Area of New York. Golden nematode, a serious introduced pest of potato, was found for the first time outside of Long Island December 2, 1967. The new infestation was detected on a farm in Steuben County, New York. Eight fields in all, comprising 350 acres, were

found infested. Six fields produced table stock, while two fields were planted for seed potatoes. New York State extended its quarantine to cover the newly infested area. During the fiscal year, surveys for the pest were conducted in 16 States. No specimens were found outside Long Island and Steuben County. Treatment of 1,432 acres was accomplished on Long Island where good progress has been made in eliminating the pest from potato lands. (I) and (E) Nationwide.

VI-421-F

Phony Peach and Peach Mosaic Diseases Reduced to Low Level. These virus diseases are serious threats to the production of certain stone fruits, particularly peaches. The spread of the disease to new areas has been prevented through destruction of infected trees and the regulation of the movement of the plants and propagating material. The incidence of phony peach disease was only .07 percent in over five million trees inspected in fiscal year 1968. The incidence of peach mosaic disease was .003 percent in over 3.4 million trees inspected. (I) and (E) Southern and Western States.

VI-431-B

Citrus Blackfly Kept Out of United States. To keep this dangerous pest out of United States citrus, a preventive program is carried out with the Republic of Mexico where the pest occurs in wide areas. An eradication zone is established in northern Mexico, while the remainder of the country is under a biological program. A total of 782,925 host plants was inspected during 1968 with 111,606 receiving treatment. Isolated infestations of the pest were eradicated in Key West, Florida, in 1934 and southern Texas in 1956. (I) and (E) Mexico, Arizona, Texas.

VI-44-C

Sterility Technique Replaces Chemicals in Mexican Fruit Fly Control. More than 23,000,000 sterilized Mexican fruit flies were released during 1967 in Tijuana, Ensenada, and Tecate, Baja California, Mexico. This field application of the sterile technique has eliminated chemical control in those areas and has been successful in protecting California and Arizona citrus from attacks by this serious pest. (I) Mexico.

VI-44-C

Burrowing Nematode Survey Expanded. After completion of the major nursery survey in June 1967, attention was concentrated on grove survey. A total of 438 groves was inspected during the year and 117 were found infested for the first time. It was necessary to collect and examine over 180,000 samples to find these infestations. The most significant development in the survey was the adjustment in sampling made through a biometrical study which provides for greater surveillance with no increase in resources. The barrier treatment program around infested groves continues to be effective in preventing spread. (I) and (E) Florida.

VI-44-F

Khapra Beetle Infestations Eliminated. No known infestations of this serious pest of stored grain exist in the United States or Mexico as a result of a cooperative eradication program in these two countries. Since the pest was first found in California in 1953, infestations have been found and eradicated in over 800 locations in Arizona, California, New Mexico, Texas, and the Republic of Mexico. Prompt detection and treatment of infestations since 1953 have prevented the spread of this pest over wide areas of the United States, thus precluding extensive treatments of grain storage sites. A total of 11,109 properties was inspected in 31 States in the United States and nine States in Mexico during the fiscal year. No new infestations were found (I) and (E) Southwestern States, Mexico.

VI-48-C

Forests

Chemicals Aid in Production of Tree Seedlings. Several soil fumigants, herbicides, and fungicides, such as methyl bromide, maneb, allyl alcohol, cyanomethylmercuri guanidine, heptachlor, dishloropropene, captan, ferbam are used to control a wide variety of weeds, insects, and diseases by treating seedling beds in one or more of 14 National Forest tree nurseries.
(I) National Forest Tree Nurseries--Nationwide. VI-5-A

Forest Lands Surveyed to Detect and Assess Pest Outbreaks. An effective forest pest control program requires responsible administration and sound technology to discover and assess pest outbreaks. Some 480 million acres of forest land were examined by Federal and State Pest Control personnel, both from the air and on the ground to detect and assess the insect and disease situation. During the year 25 States participated in the program to share costs of forest insect and disease survey and evaluation on non-Federal lands.
(E) 25 Cooperating States. (I) Washington, D.C. VI-5-A

Removal of Alternate Host Controls White Pine Blister Rust. In total, 1.7 million gooseberry and currant bushes on 112,241 acres were destroyed by hand roguing or herbicide treatment to prevent disease spread. Surveys were made on 1.9 million acres to determine disease status, control needs, and best control methods for protection of each stand.
(E) Cooperating States. (I) Washington, D.C. VI-5-B

Assessment of a Biological Control for a Serious Root Rot Disease is Underway. Field tests were installed to appraise the degree of control achieved by a harmless organism, Peniophora gigantea, that creates a biological barrier, thus preventing annosus root rot from spreading and causing mortality in red pine plantations.
(E) States of Connecticut and Rhode Island. (I) Upper Darby, Pa. VI-5-B

Cultural Practices Control Dwarf Mistletoe. Suppression of dwarf mistletoe in connection with silvicultural operations and timber harvest was done in coniferous stands on a number of National Forests in the West. Control was accomplished during site preparation and rehabilitation following harvest cuts or by sanitizing young growing stock following harvest of merchantable overstory. (I) Portland, Oreg.; Missoula, Mont.; San Francisco, Calif.; and Albuquerque, N. Mex. VI-5-B

Oak Wilt Infected Trees Located and Treated. Federal-State cooperative oak wilt surveys and control were carried out in Pennsylvania, Virginia, West Virginia, and North Carolina. In total, some 55 million acres were covered by aerial surveys and 6,576 infected trees were treated. Infected trees were treated by deep girdling or by felling to eliminate sources of inoculum.
(E) States of Pennsylvania, Virginia, West Virginia, and North Carolina.
(I) Upper Darby, Pa. and Atlanta, Ga. VI-5-B

Water Replaces Oil in Lindane Sprays for Control of Bark Beetles. A 20 percent lindane emulsifiable concentrate at 1 part concentrate to 15 parts water is effective for fall, winter and spring application to control western pine beetle, Jeffrey pine beetle and the California flatheaded borer. Previously only diesel oil was recommended as the diluent. The oil often caused skin irritation and has been a hazard to personnel. Not only will safety hazard be reduced but cost will be less and source of the diluent more readily available. Diesel oil must still be used during periods of freezing weather.
(I) San Francisco, Calif. VI-5-C

X-rays Used to Predict Bark Beetle Population Trend. Four-inch circular disks of bark from trees infested with western pine beetles are taken in the field using a gasoline powered drill with a circular saw bit. These field samples are x-rayed and counts of beetle larvae, pupae or callow adults made to determine population expected to emerge. Counts also can be made of beetle predators. This method, developed by research, is now used operationally.
(I) San Francisco, Calif. VI-5-C

Parasite of Larch Casebearer Becomes Established. A survey of the parasitic wasp, Agathis pumila, released as a biological-control agent for the larch casebearer, show that establishment has occurred at 44 percent of the release sites made periodically since 1964. The degree of spread of the parasite from original release sites and the effect this may have on reduced tree defoliation remains to be determined. (I) Missoula, Mont. VI-5-C

Low Concentration of Dimethoate is Effective on Cone and Seed Insects. Hydraulic ground application of a 1 percent solution of dimethoate (Cygon) gives good control of midges and caterpillars that attack Douglas-fir cones in the Oregon Cascades. Safe, effective means of reducing seed loss is very important in seed orchard and seed production area management.
(I) Portland, Oreg. VI-5-C

New Outbreaks of European Pine Shoot Moth Controlled. The Federal-State cooperative survey for discovery of the shoot moth outside the Puget Sound containment zone was continued in Washington and Oregon. Significant new outbreaks were found around Kennewick and Walla Walla in eastern Washington and the Hermiston-Umatilla area of eastern Oregon. State of Washington carried out a tree eradication program in the vicinity of Walla Walla and a field test of chemical control in the Kennewick area. Oregon carried out an extensive control program by spraying the infested trees. (E) States of Oregon and Washington. (I) Portland, Oreg. VI-5-C

Gypsy Moth Sterile Moths and Parasites Back Up Chemical Program. An evaluation of the sterile release technique for gypsy moth control was initiated with field trials at several locations in New York and Pennsylvania. In areas with high natural populations insecticidal suppressive action was necessary prior to releasing sterile moths. Other biological control activities with major emphasis include the foreign parasite mass-rearing and

Infrequent Spraying Controls Balsam Woolly Aphid on Individual Trees. It was found that benzene hexachloride applied at 0.2 percent in water will give good control of the aphid for as long as three years and likely as long as five years. (I) Portland, Oreg.

VI-5-C

Bark Beetle Buildup Prevented in Fire-weakened Pine. A 20 percent lindane solution mixed at ratio of 1 part concentrate to 15 parts water was applied to the bole of fire-weakened ponderosa pine to prevent bark beetle attack and buildup. One treatment of the protective spray, applied from the ground using a truck mounted 50-foot boom, gave satisfactory protection during the active bark beetle period. This treatment is practical and economical in recreation and other developed areas of rather flat terrain. (I) San Francisco, Calif.

VI-5-C

Reduction of Bark Beetles by Herbicides. Studies were continued on the use of a fast-acting herbicide to reduce bark beetle broods in young ponderosa pine and lodgepole pine and in Englemann spruce. Beetles are attracted to treated trees and the adults may die and resulting brood may fail to mature, thus preventing buildup to epidemic populations. Application techniques, variability in results, timing and other problems must be resolved before the method can be used operationally. (I) Albuquerque, N. Mex.; Denver, Colo.; Portland, Oreg.; Ogden, Utah; and Missoula, Mont.

VI-5-C

Prompt Action Curtails Beetle Outbreak. A severe bark beetle outbreak in young ponderosa pine, Ashley National Forest, Utah was detected, evaluated and suppressed in less than 30 days. No insecticide was used. The 455 infested brood trees were cut, skidded to openings, piled, and burned before adult development and flight occurred. (I) Ogden, Utah

VI-5-C

Prompt Salvage of Blowdown Averts Beetle Buildup. A windstorm in December 1967 caused a considerable amount of pine timber blowdown on parts of the Eldorado, Stanislaus, and Sierra National Forests, California. Heavy infestations of bark beetles can be anticipated under these circumstances. However, most of the blowdown trees were salvaged before a bark beetle buildup could develop and threaten adjacent green timber stands. Prompt salvage was believed particularly effective in averting tree killing in the Bass Lake Recreation Area. (I) San Francisco, Calif.

VI-5-C

Sanitation-Salvage Cutting Assists in Bark Beetle Control. Various ground disturbances and two drought years have provided enough breeding material for Douglas-fir beetle populations to increase in several parts of the West. Removal of infested groups by clearcutting them was carried out in a number of forest stands. Timber sales in F.Y. 1968 on the Six Rivers National Forest (northern California) alone totaled over 50 million board feet on what is considered salvage sales. (I) Portland, Oreg.; Missoula, Mont.; and San Francisco, Calif.

VI-5-C

colonization program. Several candidate parasites from India, never previously introduced into the United States, are included.
(I) and (E) New York and Pennsylvania. VI-5-C

Outlying Infestations of Gypsy Moth Treated. About 135,000 acres in outlying infestations in New Jersey, New York, and Pennsylvania were treated in the spring of 1968 to halt spread. Carbaryl (Sevin) was the principal insecticide of choice; however, 38,000 acres of the total were treated with Dylox applied as low volume concentration to test the effectiveness of this material. Containment of the gypsy moth in the Northeast has protected more than 100 million acres of susceptible forests in 25 States in the eastern half of the nation. A small infestation, discovered in Michigan in 1966 consisting of 24,300 acres, received eradication treatment in the spring of 1967. Though extensive surveys have been carried out in Michigan since that time, no additional moths have been taken.
(I) and (E) northeastern States. VI-5-C

Gains Made in an Effective Control for Jack-Pine Budworm. Several non-persistent insecticides were found effective in controlling jack-pine budworm. Matacil, Zectran, and Dylox were field tested against this insect. The three materials gave reductions in population levels of 90.6, 85.9, and 80.0 percent, respectively. These degrees of effectiveness are of sufficient magnitude to warrant further consideration.
(E) State of Wisconsin (I) Upper Darby, Pa. VI-5-C

Timely Surveillance of Population Levels Pays Dividends. Thorough and timely evaluations of jack-pine budworm outbreaks on National Forests in northern Michigan and Wisconsin led to the cancellation of a 174,000-acre aerial spray project. Basis for cancellation was due primarily to a last minute natural reduction of the budworm population.
(I) Upper Darby, Pa. VI-5-C

Fall and Burn Method Used in Control of Mountain Pine Beetle. The mountain pine beetle epidemic, Teton National Forest, Wyoming, required continued control. Less reliance was placed on chemical treatment. This year 87 percent of the control effort was by the "fall and burn" method compared to only 51 percent the previous year. (I) Ogden, Utah VI-5-C

DDT Use Decreased for Pine Tip Moth Control. It has been determined that loss of tree height growth caused by Nantucket pine tip moth attacks in young pine plantations is insignificant. Therefore use of DDT for control of this insect has been discontinued on National Forests in the South.
(I) Atlanta, Ga. VI-5-C

Use of Benzene Hexachloride Reduced. Logging as a control measure in southern pine beetle outbreak centers reduced the amount of BHC required on cooperative and National Forest projects by about 70 percent in North Carolina and about 40 percent in Alabama, Louisiana, Mississippi, and Texas compared to the previous year. Also, on the Kisatchie National Forest in Louisiana,

about 50 percent less BHC was used after results of an evaluation showed that spraying of stumps in treatment of black turpentine beetle was not necessary except in low-wet areas.

(I) Atlanta, Ga. (E) Alabama; Louisiana; North Carolina; Mississippi; Texas

VI-5-C

Logging Accelerated in Spruce Beetle Outbreak. A serious outbreak of spruce beetle on the Flathead National Forest, Montana is being handled by accelerated logging. At least 50 million board feet are currently infested. Priorities for logging were revised and trees in the largest infested areas of mature and overmature spruce will be cut and removed before beetle flight in 1970. No chemical control is planned. (I) Missoula, Mont.

VI-5-C

Sumithion Found Safe but of Questionable Effectiveness Against Spruce Budworm. A new non-persistent insecticide, Sumithion, was field tested against the spruce budworm in Maine. Results were not encouraging, averaging about 55 percent reduction in budworm populations. No significant adverse effects on birds, fish or terrestrial animals were found by fish and wildlife monitoring teams. An in-depth review of the test will be made to determine probable causes of the limited reduction in insect populations and the merits of further work with this insecticide. (E) State of Maine. (I) Upper Darby, Pa.

VI-5-C

Testing of Zectran for Control of Tree Defoliating Insects. In a continuing effort to find a replacement for chlorinated hydrocarbons, the carbamate Zectran was field tested against the spruce budworm at a rate of 1 ounce per acre and the western hemlock looper at a rate of 2.4 ounces per acre. Spray was applied with a bi-fluid system that produced aerosol-sized droplets. Looper mortality attributed to the insecticide was less than 25 percent. Budworm populations were reduced 70 percent in one spray block and 48 percent in another. These results, based on dosage rates used and spray technology tested, are not good enough to recommend operational use of the material and application method at this time. Further testing is planned. (I) Missoula, Mont. and Portland, Oreg.

VI-5-C

Herbicides Remove Competition in Tree Plantations. Ammate, simazine, atrazine, and dalapon are used as pre-emergence and foliar sprays to control grass and weeds in tree plantations.

(I) Milwaukee, Wisc.; Portland, Oreg.; San Francisco, Calif.

VI-5-D

Control of Brush Regrowth on Fuelbreaks. Broadcast spray applications of herbicides--commonly low volatile ester 2,4-D and/or 2,4,5-T in water-oil emulsion--for two seasons following fuelbreak construction, plus periodic hand or broadcast applications in later years retards brush regrowth and encroachment on fuelbreaks. The elimination of heavy fuel and fire-hazardous brush on 200 feet or wider strips, and subsequent establishment of a permanent cover of perennial grasses or other light fuel ground cover, provides a location where fireline can be easily constructed and held in the event a wildfire escapes initial control action. (I) Albuquerque, N. Mex.; San Francisco, Calif.

VI-5-G

Limited Herbicide Use Helps Maintain or Improve Wildlife Habitat on National Forests. Herbicides are used to induce basal sprouting by top-killing shrubs that have grown beyond the reach of big game animals. Also, a limited amount of herbicides are used to kill back reinvasion of tree growth in maintenance of small wildlife openings in forest stands.

(I) Many National Forests Nationwide

VI-5-G

Repellants and Rodenticides Used as an Aid to Successful Reforestation.

Anthraquinone, thiram, and endrin are used to coat tree seed in direct seeding projects on the National Forests to repel birds and small rodents that feed on tree seeds. Strychnine, sodium fluoro-acetate, and gaphacide are used to control porcupines, gophers, rabbits, and other small rodents on National Forest areas being reforested. (I) Most National Forests Nationwide

VI-5-G

Safer Rodenticide Under Test. A cooperative study with the University of California at Davis is being conducted to test Diphacin as a substitute for sodium fluoro-acetate to control seed-eating rodents prior to reforestation. (I) San Francisco, Calif. (E) Univ. of Calif. at Davis

VI-5-G

Undesirable Trees and Brush Eliminated by Herbicides. Various formulations of cacodylic acid, 2,4-D, and 2,4,5-T are used to control brush to reclaim high-quality forest land for tree growth and to thin overstocked timber stands on the National Forests. The herbicides are applied as an aerial spray or by injection into tree trunks with special metering tools. (I) Most National Forests Nationwide

VI-5-G

Herbicides are used in kill back operations on forest stands. Small white openings in forest stands. Many National Forests Nationwide.

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Forest stands are being treated with herbicides. Small white openings in forest stands. Many National Forests Nationwide.

Forest stands are being treated with herbicides. Small white openings in forest stands. Many National Forests Nationwide.

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Forest stands are being treated with herbicides. Small white openings in forest stands. Many National Forests Nationwide.

VI-5-1

Forest stands are being treated with herbicides. Small white openings in forest stands. Many National Forests Nationwide.

VI-5-1

Forest stands are being treated with herbicides. Small white openings in forest stands. Many National Forests Nationwide.

TARGET VII

TO MONITOR THE PRESENCE AND DISTRIBUTION OF PESTICIDES IN PLANTS, ANIMALS AND THEIR PRODUCTS, AND IN OTHER PARTS OF THE ENVIRONMENT

Monitoring Program for Meat. Domestic and imported meat is monitored for pesticide residues. A total of 3,345 samples (930 imported meat samples) were randomly selected and analyzed for chlorinated hydrocarbon insecticide residues. Of these samples, 1.6 percent of the domestic meat samples and 4.5 percent of the imported meat samples contained illegal residues. Analysis of meat for chlorinated hydrocarbon insecticide residues, in conjunction with regulatory control actions, was performed on 1,000 samples (829 imported meat samples), and 2.3 percent of the domestic meat samples and 24.3 percent of the imported meat samples revealed illegal residues. No excessive residues of carbamate and organo-phosphorus insecticides were found in a total of 197 domestic meat samples tested. VII

National Soil Monitoring Program Expanded. The Nationwide Pesticide Monitoring Program was initiated in the States of Maine, Virginia, Georgia, Idaho, Nebraska, and Washington. Soil and crop samples have been taken from one-fourth of the total sites selected for each of these States; however, chemical analyses have not been completed. Sites for other States have been selected and are ready for the program to begin in fiscal year 1969. (I) Maryland, Maine, Va., Ga., Idaho, Nebr., Wash. VII

Special Study of Pesticide Disposal Pits. The Soil Conservation Service, the Soil and Water Conservation Research and the Plant Pest Control Divisions of ARS cooperated in a preliminary study of pesticide migration from pesticide waste disposal pits. The work was carried out at two locations in Mississippi. Results, although not conclusive, showed that pesticides can be carried to various depths as saturation of the upper soil particles is reached. (I) Jackson, Oxford, and Gulfport, Mississippi. VII

Pesticide Residues Surveyed in Peanuts. A pesticide residue survey was made in the peanut-growing areas in seven States. Three pesticides were detected in the nuts: dieldrin, DDT, and pentachloronitrobenzene (PCNB). DDT was found in 1.3 percent of the samples, with a range of 0.02 ppm to 0.07 ppm. PCNB was found in less than 1 percent with a range 0.10 ppm to 0.24 ppm, and dieldrin in 13.3 percent with a range of 0.01 ppm to 0.50 ppm. (I) Gulfport, Miss., and Southeastern States. VII

Sugar Beets Samples for Residues in 14 States. A special survey was made in the major sugar beet growing areas of the United States. About 139 samples each of roots and tops were collected from 14 States. The roots and tops were analyzed separately. Dieldrin was found in samples from five of the States. Residues of dieldrin ranging from 0.01 ppm to 0.15 ppm were found in 11 root samples. Three samples of tops contained 0.01 ppm of dieldrin. DDT was found in 4 percent of the samples ranging from 0.01 ppm to 0.23 ppm. One third of these samples were beet tops and the remainder roots. One beet top sample had 32.6 ppm of toxaphene. (I) Central and western States. VII

Pesticide Residues in Feedstuffs. Preliminary results of a survey of nine halogenated hydrocarbon pesticides in samples of corn, soybean meals, alfalfa meal, fishmeal and fat, obtained on the open market in four different areas of the country showed some samples free of pesticides and others contained only minute traces. Many samples contained multiple residues in the range of 0.01 to 0.1 ppm of each pesticide present. The most frequently found residues in the feedstuffs, except for corn, were DDT and its metabolites. Fishmeal contained residues of all pesticides analyzed for except methoxychlor and toxaphene. (E) Ohio Agricultural Research and Development Center. VII

TARGET VIII

TO ADMINISTER THE REGULATORY STATUE--THE FEDERAL INSECTICIDE,
FUNGICIDE, AND RODENTICIDE ACT--TO ASSURE PROPERLY LABELED
PESTICIDES, WITH GUIDELINES FOR THEIR SAFE AND EFFECTIVE USE,
AND TO PREVENT THE MARKETING OF HARMFUL, ADULTERATED,
OR MISBRANDED PRODUCTS

Registration of Economic Poisons. In 1968, registration was issued for 4,666 new products. Amendments to currently registered products in the form of new patterns of use, changes in formulation, or strengthening of precautionary statements were accepted for 10,961 products. The registration of 16,376 products was cancelled either voluntarily or from action taken by the Department primarily in relation to tolerance requirements for pesticides on food crops. (I) Washington, D.C. VIII

Residue Tolerance Requirements for Pesticides Used on Agricultural Commodities. The joint USDA-HEW policy requiring finite tolerances or exemptions to support continued registration of pesticide uses previously accepted on a zero-tolerance or no-residue basis became effective January 1, 1968. There were 424 chemicals registered for use on food and food commodities. Of these 69 had tolerances for all uses, 106 had tolerances for some uses and 249 had no tolerances. Under this policy, registration would be extended for one year, but not beyond December 31, 1970, for those uses on which petitions for tolerances were pending or on which work was being done to obtain tolerances. Extensions have been granted on 226 chemicals. All uses for 87 chemicals were cancelled and registration for one or more uses of 80 other chemicals were cancelled. Although there were several problem areas to be resolved in putting this policy into effect, there was no drastic effect on pesticide usage and no food crops were left without any means of pest control. (I) Washington, D.C. VIII

Dissemination of Information to State Regulatory Officials. To insure uniformity of registration and labeling policies between the states and the Federal Government, the Division notifies the state regulatory officials of new chemicals accepted for registration. Information is also furnished on new chemicals being used experimentally under the temporary permit provisions of the Act. A total of 106 such notices were sent to state officials during the year. (I) Washington, D.C. VIII

Product Surveillance. There has been a substantial increase in the number of samples collected and a corresponding increase in enforcement actions taken. In fiscal year 1968, 211 samples were collected, 363 seizures were initiated, and 1,213 citations were issued for alleged violations of the Act. Significant changes were made in the enforcement program during the past year in three important areas:

1. A recall program was initiated to effectively remove violative products from channels of trade.
2. Emphasis was placed upon corrective action by companies alleged to have violated the Act.
3. Regulatory activities with respect to imported pesticide chemicals were expanded. (I) Washington, D.C.

VIII

TARGET IX

TO EDUCATE AND INFORM THE PUBLIC ABOUT THE IMPORTANCE
OF PESTICIDES AND PEST CONTROL, AND THE NEED FOR SAFE
AND PROPER USE OF PESTICIDES; MAINTAIN A PESTICIDES
INFORMATION CENTER; COORDINATE AND REVIEW
PESTICIDE AND PESTICIDE-RELATED ACTIVITIES
OF THE U. S. DEPARTMENT OF AGRICULTURE
AND COORDINATE THEM WITH OTHER
FEDERAL, STATE, AND PRIVATE
ORGANIZATIONS

Information-Education

The Department continued to conduct an intensive national pesticide safety-pest control information and education program during FY 1968. The audience for the program was both the general consuming public and specific interest groups including farmers and ranchers, housewives and gardeners, commercial applicators and food processors, dealers and manufacturers. Emphasis was placed on the (1) challenge of pests and their control, (2) the need for safe use of pesticides and related governmental safeguards, and (3) the development of additional safe and effective methods of control.

Within the Department, the information-education program was carried out by the Office of Information, Agricultural Research Service, Federal Extension Service, Forest Service, and other concerned agencies with the Office of Information acting as program coordinator. In turn, Department activities were closely linked with those of the States through the Cooperative State Extension Services, and with other Federal Departments, educational institutions, and private organizations. The mass communications media--newspapers and magazines, television and radio--continued to offer excellent cooperation in the use of program materials for public consumption. Here are the highlights of the 1968 program as conducted by the USDA and its cooperators:

Radio and Television

Safety Spots for National TV Audience. The USDA Pesticide Safety Program was endorsed for the fifth consecutive year by The Advertising Council, public service advisor to the broadcasting industry. In conjunction with this valuable

endorsement, the Department distributed spot announcements to the three major television networks, (NBC, CBS, and ABC) and over 600 commercial TV stations. Materials made available for television screening included four full-color filmed spots from 20 seconds to one minute in length and four color slides with 10-second scripts. By arrangement with The Advertising Council, the filmed announcements were produced in consultation with the networks in accordance with the highest public service standards. Wide usage of these materials was reported, including TV showings during prime evening time. The spots offered safe use advice and also stressed the value of pesticides to modern society. (I) Washington, D. C.

Celebrities Give Safety Tips to Radio Listeners. Four nationally-known entertainers--Phyllis Diller, Jimmy Durante, Eva Gabor, and Arthur Godfrey--recorded 11 pesticide safety announcements at the request of the Department for public service use. Records containing these 30, 40, and 60-second spots were distributed to more than 4,600 radio stations across the nation, and were broadcast frequently. Along with the safety materials for television, the radio announcements received the public service endorsement of The Advertising Council for the fifth successive year. Both the radio and television announcements were made available to the State Cooperative Extension Service for use before local, state, and regional groups. (I) Washington, D. C.

TV Features Tell Pest Control Story. The numerous activities of the Department related to pest control research, regulation, and monitoring were reported to the general public and specialized audiences in 24 television features produced and distributed by the USDA television service in cooperation with the Agricultural Research Service, Federal Extension Service, and other agencies. The materials included thirteen 3-1/2 minute features -- on subjects ranging from insect diapause to pesticide safety on cookouts -- which were released to an average of 300 stations through the Department's Down to Earth series. Stations also received four films and two slide features on USDA's pesticide monitoring and plant quarantine programs. The regular Department show Across the Fence--screened on 40 TV stations weekly--featured interviews with pest control and pesticide safety experts during the year. (I) Washington, D. C.

Radio Reports for Consumers, Farmers. More than 50 radio items were produced and released in support of the USDA pesticide safety-pest control information program. Pesticide use and safety, research on biological and other advanced control methods, and pest infestation warnings were among the subjects discussed on regular USDA recorded radio services including Consumer Time (320 stations), Agri-tape (400 stations), Agriculture USA (220 stations), and American Farmer (60 stations). Voice of America made three recordings with subject matter specialists in the pest control area for overseas consumption. These materials were prepared by the Agricultural Research Service and other agencies in cooperation with the Department's radio services. (I) Washington, D.C.

"Open House" on Television. An 8 minute program was aired by an Oakland, California television station in connection with the Agricultural Science Open

House at the San Francisco pesticides laboratory of the Agricultural Research Service. The program was based on a script, questions, and color slides provided by ARS. (I) Washington, D. C.

News Releases, Feature Stories, Newsletters

Press Releases and Articles. Over 100 press releases were issued by the Department on subjects ranging from seizure of illegally marketed pesticides products to soil monitoring for residues and research on new biological pest control techniques. A number of releases were produced jointly by USDA and the Food and Drug Administration, HEW, on changes in pesticide tolerances for food crops and on discussions with foreign governments concerning residues. The Agricultural Research magazine kept the public informed on the latest developments in pest research through 46 articles in the subject area. (I) Washington, D. C.

News Media Feature Research. Several major feature stories on development of biological control techniques by USDA researchers appeared in The New York Times in November and March. The stories emphasized the Department's work on insect sterilization, use of viruses and hormones, predators and parasites and other non-pesticide pest control methods, and featured Dr. E. F. Knipling, head of the ARS Entomology Research Division. The Department supplied background information and arranged interviews with Dr. Knipling and other leading USDA pest control authorities. Pest control features were also prepared for important agricultural publications such as Progressive Farmer, and information was supplied to major magazines including Newsweek and Nation's Business. (I) Washington, D. C.

Special News Interpretation for States. The Federal Extension Service intensified and expanded its program to alert the states to the issuance of special news releases, regulations, registration changes, and similar pesticide and pest control developments as they might affect individual states. Through special newsletters and telephone calls, the states are constantly kept informed on matters concerned with interpretations, extensions, use limitations, cancellations of registered pesticide uses, the no residue-zero tolerance concept, accident reporting, analysis and problem situations concerned with pesticide residues in meats and other food products. (I and E) Washington, D. C., and State Extension Service.

Newsletters. The Federal and State Extension Services use newsletters as the primary means for communicating pesticide-chemicals information to specific clientele groups which includes dealers, applicators, pest control operators, commercial farmers, civic and special interest groups and organizations and consumers. State Extension specialists and county agents depend almost entirely on this expeditious means for disseminating pesticide-chemicals information on registered uses, cancellations, changes, safety, storage, handling, transportation and protecting the health of man, plants, animals and quality of the environment. (I and E) Washington, D. C., and State Extension Services.

Special Projects

Displays at Health Information Centers. More than 120,000 copies of three USDA pesticide safety-pest control publications were distributed to patrons of 400 independent pharmacies across the Nation. By special arrangement with the American Pharmaceutical Association, these materials were displayed for two-month periods in Family Health Information Centers located in the pharmacies. The publications were PA # 589, Safe Use of Pesticides ... in the Home ... in the Garden (August-September 1967); the fact sheet, Your Home and Safe Use of Pesticides (February-March 1968); and PA # 839, 3 Leaves Mean Poison Ivy, (April-May 1968) advising safe, effective herbicide eradication of poisonous plants. In addition, 400 USDA posters with the message, Use Pesticides Safely ... Read the Label, were displayed by the Health Centers during June and July, 1968. The program with the American Pharmaceutical Assn.' is continuing on an indefinite basis with at least four more Department publications on pest control-related subjects scheduled for use during the 1969 fiscal year. (I) Washington, D. C.

Monthly Column for Farm Press. A monthly column providing the latest information for farmers on federal pesticide regulations, pest control research, monitoring, and control activities, and safe use advice was initiated by the Department. This column, which gathers its materials from all concerned USDA agencies, is distributed to 850 farm magazines and newspaper farm editors and is being used either in its entirety or as a source of news stories. (I) Washington, D. C.

Safety Cartoons For Farm Audience. Fifteen separate black-and-white cartoons emphasizing the need for safety in handling and applying pesticides were distributed to 75 farm magazines and 75 farm editors of daily newspapers for periodic use in connection with pest control stories. Produced by the Department, the cartoons offered farm-oriented safety tips for the protection of people, crops, domestic animals, and wildlife. The Federal Extension Service also sent another 24 of these cartoons (in addition to a distribution the previous year) to its State information and education specialists for use in weekly newspapers, magazines, newsletters and elsewhere. (I) Washington, D. C.

Label Effectiveness Study Underway. The effectiveness of pesticide labels in communicating instructions and precautions to users is being studied by the University of Illinois under a two-year, \$50,000 research contract awarded by the Pesticides Regulation Division, ARS. With more than 45,000 labels currently registered with USDA, the Department is seeking to determine whether pesticide users read, understand, and follow protective label instructions, and how the label can be improved to increase its value as a communications tool. (I and E) Washington, D. C., and Illinois.

Kits for Poison Prevention Week. USDA materials on pest control and pesticide safety were included in 2,000 program kits distributed by the American Pharmaceutical Association for National Poison Prevention Week, March 17-23, 1968. The kits were sent to state and local pharmacy associations and individual pharmacies for use in presenting programs before civic and youth groups. The

Department items were the booklet, The War That Never Ends ... Facts About Pest Control, and a model speech and three charts illustrating the pesticide accident problem and urging greater care and caution in handling pesticides. (I) Washington, D. C.

Registration Kit for Industry. Approximately 2,500 "Pesticide Registration Information" kits were prepared and distributed to persons and companies that have registered pesticides with PRD. The kit contains current information, interpretations, and applications and is designed to answer questions on how to register a pesticide. Two hundred kits were included in the teaching materials used at the Society of Industrial Microbiology Summer Institute. (I) Washington, D. C.

Zero Tolerance Campaign. Special ARS, FES, and State Extension information programs were instituted to alert growers, industry, and State regulatory agencies to the December 31 deadline for the cancellation of pesticide uses registered with the Department on a "zero tolerance" basis. An explanatory article and letter was sent to 60 magazines, brief items were prepared for industry publications and the farm press, letters and relevant material were sent to State Extension pesticide coordinators, and a flyer on the subject went to all firms registering products with the Pesticide Regulation Division, and to State regulatory agencies. After the deadline was reached, two releases were issued on pesticide uses and products that have been cancelled. (I and E) Washington, D. C., and State Extension Services.

Forest Pest Control Information. Forest insect aerial spray projects conducted in Maine, Montana, and Washington were preceded and accompanied by intensive efforts to inform local citizens about the forest insect outbreaks, their seriousness, proposed course of action, and steps to be taken to insure that the pesticide used would be applied safely. Under this broad-scale information approach, the Forest Service disseminated pertinent information through civic groups, special meetings, press briefings, news releases, and brochures. Biologists were invited to describe how distribution of pesticides in the environment would be measured and controlled during the project. (I and E) Washington, D. C.; Maine, Montana, Washington,

Pesticide Use Records. The importance to pesticide-chemical users of keeping complete and detailed long-range use records was given renewed emphasis by the Department and the State Extension Chemical Coordinators at meetings with producer, commodity, applicator, pest control operator, and industry groups. The record book developed cooperatively by North Dakota and FES in 1967 has been well received and most States are encouraging pesticide-chemical users to keep and use records as a tool for decision making and as a means for preventing undue losses from excessive residues and liability suits, and for promoting safe use. Analyses of these records and results also have helped reduce environmental pollution through encouragement of use of safer, less persistent materials, adoption of integrated pest control programs, and reduction of the number and/or rates of application of some materials. (I and E) Washington, D. C., and State Extension Services.

Schools, Youth Groups

Packets for Students, Youth Groups. As part of a continuing program to supply teachers and students with educational materials on pest and their control, more than 1,500 additional packets titled Our Struggle Against Pests, were distributed on request to general science and biology teachers in junior and senior high schools, elementary science supervisors, vocational agriculture teachers and other educators for classroom or club use. Since the initial distribution early in 1967 in cooperation with National Science Teachers Assn. (NSTA), a division of the National Education Assn. (NEA), nearly 36,000 packets have been put in the hands of teachers and youth leaders across the nation. Teachers and others have subsequently ordered about 200,000 copies of some of the publications in the packet for student use, 28,000 of these during the 1968 fiscal year. The packets include a 24-page booklet, three student or classroom pest-related science projects, the guide for a slide set/film strip, and other items. (I) Washington, D.C.

Film Strip, Movie for Schools. 10,000 audio-visual supervisors in the Nation's school systems received copies of the narrative guide for the color slide set/film strip. Man Against Pests, and also a flyer describing the color motion picture, Pests or Plenty? both produced by the Department. The distribution of the two items was arranged with the Department of Audio Visual Instruction, a branch of the National Education Association, (NEA). The 66-frame slide set/film strip describes the challenge of pests and their control in an historic context designed specifically for classroom use, while the 13-minute consumer-oriented film relates the value of modern pest control to the wholesome, plentiful food supply available in this country. The slide set/film strip accompanied by a recorded narration could be purchased, with the film available on a loan basis from state libraries and USDA. (I) Washington, D. C.

Quarantine Facts at Science Fairs. Plant quarantine restrictions for preventing the spread of pests were described in a program aid prepared by the Agricultural Research Service and distributed to 1,500 leaders, officials, and sponsors of high school science fairs across the nation. A shorter statement covering quarantines was included in the more than 76,000 copies of the Science Activities Handbook which goes to science fair participants, science teachers, and high school science club supervisors. (I) Washington, D. C.

Motion Pictures, Slides, Photo Stories, Exhibits

Motion Pictures. Nearly 2.7 million viewers saw Pests or Plenty?, the 13-minute, consumer-oriented color film, in over 1,000 separate showings, more than double the number for 1967. This movie, which describes how our food supply is protected from pests, had 993 screenings before live audiences, including student groups, compared with 435 the previous year. The vast majority of viewers, however, saw the film on television where it was screened 61 times on stations across the Nation. Safe Use of Pesticides, the 28-minute color film advising farmers on how to minimize crop residues, had 19 television showings before an estimated 817,000 viewers and 1,085 screenings before live audiences

totalling 33,000 people. A new 28-minute movie "Who Shall Reap?" on the world-wide challenge of pests to man neared completion with release scheduled for early in 1969. (I) Washington, D. C.

Color Slide Sets. FES and the Cooperative State Extension Services of Georgia and South Carolina cooperated in the development of over 500 color 2x2" weed, insect and disease identification slides. Initial sets of these are being distributed to each State and arrangements have been made with the USDA Office of Information to make additional sets available for purchase by Extension, industry and related groups. Volume duplication on these projects will result in savings to Extension of up to \$5,000 per year over the next 10 - 15 years. Industry also has expressed an interest in purchasing sets of these slides for use by their dealers, fieldmen and for use in their publications. (I and E) Washington, D. C., and the Georgia and South Carolina State Cooperative Extension Services.

Picture Stories. The intensive research underway to develop more effective and safe methods for control of Dutch Elm Disease was dramatized in Death of a Giant, a photo story produced by the Agricultural Research Service and widely used by newspapers, magazines, and schools. Two other picture stories prepared by ARS; Guarding Our Agricultural Resources in the Jet Age, and Guarding Our Agricultural Resources on the Border, dealt with plant quarantine programs designed to prevent pests from entering the country, thereby reducing the need for using pesticides or other control methods. (I) Washington, D. C.

Poison Prevention Exhibits. Several consumer-directed exhibits on poison prevention in the home and pesticide safety were developed by the State Extension Exhibits Services. Many of these were displayed at county and State fairs. Some of these exhibits have also become a permanent part of district Extension office resources and are maintained in libraries and elsewhere for county and local use. New Jersey, in cooperation with FES, developed a "Poisons in Your Home" exhibit with kit for use with adult and older youth groups. The kits, as used, consists of three pamphlets on poisons in the home, directions for constructing the exhibit, and a slide set with script. This kit was modified by the West Virginia and Virginia Extension Services and utilized in programs aimed at the householder and parent. Printed materials developed for use in the "Poisons In Your Home" project have also been made available for national use on a cost-share basis. (I and E) Washington, D. C., and the New Jersey, West Virginia and Virginia State Extension Services.

Pesticides Policy Projected. The Department policy exhibit, Protect ... Use Pesticides Safely, emphasizing concern for protection of the environment from pesticides misuse as well as protection against pests, was displayed at a number of agricultural events. Exhibit materials were supplied to the Michigan Department of Agriculture for the annual garden show in Detroit. (I) Washington, D. C.

Publications

Popular Materials for General Public. More than 50,000 copies of a new brochure, Pesticides Registration -- How It Protects You (PA # 835), were distributed, along with over 60,000 copies of 3 Leaves Mean Poison Ivy (PA # 839), an illustrated pamphlet describing the benefits to human health involved in the safe, efficient eradication of poisonous plants with herbicides. The booklets Our Struggle Against Pests (PA # 772), and Saving Our Forests (PA # 666), and the pamphlets Safe Use of Pesticides in the Home, In the Garden (PA # 589), and Farmers' Checklist for Pesticide Safety (PA # 622) continued to enjoy wide readership. A new leaflet, Protecting Honey Bees from Pesticides, was distributed to farmers and beekeepers. (I) Washington, D. C.

Fact Sheets. Over 44,000 copies of a revised edition of the illustrated 4-page fact sheet, Your Home and Safe Use of Pesticides were sent on request to housewives and homeowners, schools and civic organizations. After the fact sheet was mentioned in U.S. Consumer News, 5,000 copies of the sheet were distributed to low-income residents in Boston by Action for Boston Community Development, Inc. The 12-page fact booklet, The War That Never Ends ... Facts About Pest Control, was put in the hands of 15,000 people interested in Department policy and activities in the pest control field. (I) Washington, D.C.

Quarantine Flyers. Two flyers designed to gain public cooperation in halting the spread of destructive pests were produced in support of programs conducted by the Plant Pest Control Division, Agricultural Research Service. More than 200,000 copies of Being Transferred? Leave Your Enemies Behind were put in the hands of military personnel before reassignment. About 80,000 copies of Do You Swap Plants, Bulbs and Tubers? were distributed, including 9,000 copies to members of national horticultural societies. (I) Washington, D. C.

New Reference Publications. The first comprehensive summary of pesticides registration procedures and the setting and enforcement of tolerances was contained in The Regulation of Pesticides in the United States, a 231-page publication jointly issued by USDA and the Food and Drug Administration, HEW. A new Agricultural Handbook, Suggested Guide for Use of Fungicides and Nematocides to Control Plant Diseases and Nematodes, was approved for publication as a counterpart of handbooks on insecticides and herbicides issued periodically by the Agricultural Research Service. Pesticides as potential pollutants of the environment were placed in proper perspective in a landmark report, Waste in Relation to Agriculture and Forestry, which received wide distribution. (I) Washington, D. C.

Publications Updated. Approximately 75 additional Department publications on farm, forest, and household insects were revised by ARS and Forest Service to include the latest pesticides information consistent with USDA pest control policy, and current research developments on safety and control methods. Thirty publications containing outdated pesticide recommendations have been or are being replaced with current materials. Forest Service also expanded its Forest Pest Leaflet series by publishing 11 new illustrated leaflets containing chemical control recommendations and pertinent precautions for safe use. (I) Washington, D. C.

Spanish Translations. Five publications used in the Department's pest control and pesticide safety information program were translated into Spanish by the Agency for International Development for distribution through AID missions in Latin America. The items were the fact sheet, Your Home and Safe Use of Pesticides, Farmers' Checklist for Pesticide Safety, and three student or classroom science projects from the USDA pest control information packet for the schools: Finding Hidden Insects, Trapping Insects with Light and Killing Weeds with Herbicides. (I) Washington, D. C.

States Develop New Materials. All States developed more factual pesticide-chemicals publications designed to help user audiences make sounder decisions. Outstanding new materials developed for State use and made available to other States were the California Pesticide Information Safety Manual, the North Carolina Pesticide-Chemicals Handbook, the Nebraska Lawn Weeds Bulletin, and the Florida Speakers Kit on Pesticides. Ten color insect identification sheets were developed for the North Central Region by Indiana; 30 color insect and disease identification sheets were developed for national use by South Carolina, and a color weed identification booklet of the 120 major crop weeds was developed in Georgia in cooperation with the Federal Extension Service. On completion of the latter two projects, 100,000 copies will have been made available for nationwide distribution and use. Two supplements to the North-east Region Pesticide Information Manual were also distributed to holders of the manual. Numerous requests for the complete manual from industry are indicative of its wide acceptance. (I and E) Washington, D. C., and State Extension Services.

Speeches and Conferences

Speeches Before National, International Groups. The Director of Science and Education, top administrators of the Agricultural Research Service, along with leading Department scientists, delivered numerous speeches explaining overall USDA policy on pesticides and pest control along with specific aspects of Department research, regulation, control, monitoring and education programs. Some of the organizations and meetings they addressed included the Entomological Society of America, National Agricultural Chemicals Association, National Association of Farm Broadcasters, U.S.-European Conference on Pesticide Residues, Society of Industrial Microbiology Summer Institute, and the University of Florida Pest Control Conference. (I) Washington, D. C.

State Extension Leaders. More than 200,000 persons attending meetings of producers, applicators, pest control operators, dealers, State and local government officials, and conservation, wildlife, and public health groups heard FES and State Extension Pesticide Chemical Leaders/Coordinators discuss and explain USDA policy and programs on pesticides and pest control. Emphasis was placed on the safe and proper use, storage, handling, and transportation of pesticide chemicals and disposal of empty containers and wastes. (I and E) Washington, D. C., and State Extension Services.

Instruction and Training

Dealer Training. The State Cooperative Extension Services again placed major emphasis on the conduct of pesticide training conferences and schools for dealers. In 1967 the average number of dealer meetings held in the 12 States sampled was 169. It is estimated that the 1968 figure will be 10 - 15% higher. Several States are issuing certificates for attendance and completion of prescribed courses, with the calendar year shown in large bold letters. This serves as the means for encouraging annual attendance and updating the proficiency and skills of the attendees. (E) Cooperative State Extension Services.

Regional Applicator Schools. The Department and State Cooperative Extension Services sponsored and conducted six regional applicator schools for aerial and ground pesticide-chemical applicators and pest control operators during 1968. Registrants attending the schools included over 1200 applicators, pest control operators, and representatives from industry, government agencies, and organizations concerned with pesticide use, storage, handling, safety and protection of the environment. Topics covered in the two-day schools included: application techniques, ultra and low volume application, selection and calibration of equipment, drift, safety, registration, record keeping, liability, disposal and toxicities, persistence, degradability and mode of action of pesticide-chemicals. (I and E) Washington, D. C., and State Extension Services.

County-level Schools, Meetings. The States of North Carolina and Florida have developed county pesticide committees and information centers patterned on the successful nationwide Cooperative Extension system of State Pesticide-Chemical Committees and Chemical Information centers. Establishment of this county-level structure has resulted in intensification of the pesticides education program in these states. A total of 1,946 schools and meetings with 44,659 in attendance were held in North Carolina during FY 1968. This included 334 pesticide meetings, 27 special pesticide schools, and 1,589 general meetings at which pesticide safety was discussed. (I and E) Washington, D. C., and State Extension Services.

Pesticides Information Centers

Pesticides Documentation Bulletin. The National Agricultural Library (NAL) operates a Pesticides Information Center which utilizes the unique resources of the Library to provide scientific and technical information concerning all aspects of the literature on pests and their control. The Center publishes the Pesticides Documentation Bulletin, a biweekly indexing journal containing 32,000 literature citations per year from worldwide references to pesticides and pest control. Approval has been granted by the Bureau of the Budget to continue publication of this Bulletin through February 1969. (I) Washington, D. C.

Indexing and Abstracting Contract. An NAL contract with Industrial Technological Associates, Alexandria, Virginia, will provide indexing of 31,000 periodical articles from world literature on all aspects of pest and their control during FY 1969. The contract provides for descriptive cataloging and subject

indexing of all articles, and in addition, provides for including abstracts of 1/4 of the articles indexed. (I and E) Washington, D. C., and Alexandria, Virginia.

User Services. The Pesticide Information Center (NAL) published 2,000 copies of a Special Bibliography entitled, "The Toxicity of Herbicides to Mammals, Aquatic Life, Soil Microorganisms, Beneficial Insects and Cultivated Plants, 1950-1965," as NAL Library List No. 87. Other services included demand literature searches in response to more than 180 requests received during the year. (I) Washington, D. C.

INTREDIS File. The Pesticide Information Center (NAL) maintains the INTREDIS system for Literature Retrieval on Forest Pathology which contains an index to more than 20,000 abstracts dating from 1930 to the present. Since March 1968, the Center has provided more than fifty demand searches from this file. (I) Washington, D. C.

Herbicides Field Test Reports. The Pesticides Information Center (NAL) maintains a computerized data system covering all field test results of the Crops Protection Research Branch, ARS, Beltsville, Maryland. Each field test of a herbicide compound from 1951 to date is now included in these files. The file lists all details of the test including phyto-toxicity ratings for each crop and weed. (I) Washington, D. C.

User Survey. During FY 1969 the Special Surveys Branch, Statistical Reporting Service, will conduct a mail survey of present and potential users of the Pesticides Documentation Bulletin (NAL) to determine its value and any desired improvements. (I) Washington, D. C.

Cooperative Literature Services. The Pesticides Information Center maintains a cooperative agreement with the Science and Technology Division, Library of Congress. Under the terms of this agreement, the Library of Congress screens and selects worldwide literature on all aspects of pests and pest control included in more than 500 periodical titles. Completed indexing is furnished to the Center for inclusion in the Pesticides Documentation Bulletin. (I and E) Washington, D. C., and Library of Congress

State Extension Chemical Information Centers. Extension continued to provide the public with the latest information on all aspects of the safe and proper use of pesticides on crops, wildlife and protection of health and quality of the environment. In carrying out this role, the office of the FES Coordinator, Agricultural Chemicals Program, distributed some 100,000 pieces of literature to the State Extension Chemical Coordinators who head the State Chemicals Information Centers in the 50 States, Puerto Rico, the Virgin Islands and the Ryuku Islands. The materials distributed included current information on laws, regulations, registered uses and cancellations, residue tolerances, toxicities, application, safety and safe and proper use, storage and handling of pesticides. In addition, the FES Agricultural Chemicals Program Coordinator cooperated with the National Agricultural Chemical Association and the State Publications Dis-

tribution officers in arranging for bulk shipment of pesticide literature as appropriate. (I and E) Washington, D. C., and State Extension Services.

SCS Provides Pesticide Data. As part of its technical assistance to soil and water conservation districts in the various States, the SCS upon request continued to furnish information on pesticides in accord with U.S. Departments of Agriculture and Health, Education, and Welfare guidelines for use in the management of resource conservation and development programs, including fish farms, woodland, and range. This information was furnished to individuals or groups cooperating with the local districts. (I) Washington, D. C.

Coordination and Liaison

General interdepartmental coordination and planning in pesticides and related areas is accomplished through USDA participation in the Federal Committee on Pest Control (FCPC) and its several subcommittees and the Federal Weed Control Committee. These are supplemented by participation in Federal Council for Science and Technology Subcommittees on Environmental Quality and Water Resources.

Cooperation with States is effected through exchanges between Department research and extension leaders and their counterparts at agricultural experiment stations or cooperative extension services and between Department control and regulatory units and agencies of State governments or the Council of State Governments. Department scientists and research leaders have represented the United States in several meetings with representatives of foreign governments.

The several approaches to coordination and planning involve task forces, committees, work groups and scientist-to-scientist relationships. Technical competence and leadership of this and other Federal departments, States, industry and foreign governments are utilized.

Federal Committee on Pest Control

The Department continues to participate in and contribute technical competence and services to the parent interagency Federal Committee on Pest Control and its five subcommittees on research, monitoring, information, program review, and safety. Some highlights involving USDA participation are:

1. Final preparation for publication of a report outlining and summarizing Federally financed research on pest control.
2. Final preparation for publication of a report on Federal pesticide monitoring activities.
3. Review of Federal financed pest control programs for efficacy and safety and the development of suggested changes where needed.

4. Identification and evaluation of Federal pest control information programs. This Department arranged for the display of the FCPC exhibit, built by USDA, at several national meetings and provided other information services for FCPC.
5. The development of a review and evaluation mechanism for considering pesticide safety problems. This Department was instrumental in the establishment of a new FCPC Subcommittee on Safety and Pesticide Disposal.

Department Policy Coordination Committees. To insure communication, review, and planning relating to its pest control programs, the Department continues to have an active Pesticide Committee. It is composed of representatives of the agencies within the Department that are concerned with research, education, information, regulation, control and monitoring activities.

The 153 Departmental pest control programs for 1968 were reviewed by both the Departmental Pesticides Committee and the Federal Committee on Pest Control. Both committees evaluated every program on the basis of expected benefits, effectiveness, safety, and environmental considerations.

In addition the Department, in 1968, established a Food Safety Work Group. Pesticide residues in foods and feeds are a part of the concern of this group.

An Environmental Quality Executive Committee-Work Group, with Departmentwide representation, continues to consider the role of pesticides in the environment as a part of its activities.

Information Coordination. Pesticides information activities continued to be coordinated by the Office of Information both inside and outside the Department. All press releases and publications on pesticides and pest control originating in the Agricultural Research Service, Forest Service, Economic Research Service, and other USDA agencies were reviewed for Department policy considerations. Special information programs in this subject area were coordinated with and through the Departmental Pesticide Committee. Working arrangements were maintained and materials supplied to State agencies, such as the Michigan Department of Agriculture, and private organizations such as the National Education Assn., American Pharmaceutical Assn., National Agricultural Chemicals Assn., National Federation of Women's Clubs, and the national television networks.

Links with Canada. Coordination of the pesticide safety information program of Canada and the United States was begun at a January meeting in Washington between the information directors and their staffs from the Departments of Agriculture for the two nations. Following reviews of respective information programs in the pesticide field it was agreed that close coordination of the Canadian and U.S. programs was both desirable and feasible. Contacts will be maintained to achieve this objective, particularly with reference to mutual problems occurring in neighboring agricultural areas along the border. Visual and other materials made available by this Department were subsequently used as a basis for planning the new Canadian pesticides information program.

Cooperation with Defense Department. To prevent pests from entering the country, the Agricultural Research Service cooperated with the Defense Department in rewriting the domestic quarantine section of the joint Army-Navy-Air Force regulations dealing with the movement of vessels, aircraft, personnel, supplies, and other transport of the armed forces. ARS and DOD cooperation in intercepting foreign insects hitchhiking into the U.S. on materials returning from Viet Nam was publicized.

Extension Liaison. The Cooperative Extension Service maintained close liaison with National and State government agencies, organizations and groups such as the Agricultural Chemicals Associations, Safety Councils, Cotton Councils, Cannery Associations, Pest Control Associations, Aerial Applicators Association, Wildlife Organizations, and professional organizations such as the Entomological Society of America, American Phytopathological Society, and the Weed Science Society of America. It has planned and counselled with these groups on pesticide-chemical programs. Another phase of the expanded liaison effort has been the role Extension has played in gathering and disseminating information on problem situations related to pesticide usage, accidents, and safety.

State Extension Chemical Committees. The Federal and State Extension Services have encouraged the formation and use of policy and action type pesticide-chemical committees as a means for strengthening liaison, cooperation and the conduct of pesticide and pesticide-related programs among various State and local governmental agencies. As a consequence, most States now have one or more pesticide-chemical committees charged with the responsibility for reviewing and conducting programs for the mutual benefit of everyone concerned. Similar committees were established at the county-level in several states.

Discussion with European Nations. Experts and officials representing the United States of America and three European nations -- Belgium, the Federal Republic of Germany, and The Netherlands -- met in Bonn, Germany, December 18-20, 1967, to consider some significant aspects of agricultural chemicals, including their regulation and their possible impact upon consumer safety and the quality of the environment. The meeting was held at the initiative of the U.S. Department of Agriculture.

Residue data provided both the United States and the European nations were compared and evaluated. It became evident that residues generally appear to be within safe limits for all chemicals and for all foods as set up by the tolerances of the nations involved.

The delegates met again in Washington on March 26 to 29, 1968, to further explore these and other areas relating to the use of agricultural chemicals.

Representatives of the United States, The Federal Republic of Germany, and The Netherlands have agreed that the generally low levels of pesticide residue found in food products need not impede the substantial flow of trade between their Nations.

After a detailed review of procedures for setting and enforcing safe residue levels, the delegates found that the systems used in the three participating Nations are essentially the same.

The delegates agreed to free and continuous exchange of data on research and regulatory activities underway in their respective Nations.

U.S. Pesticide Regulations Outlined. In connection with the 1967 meeting with Belgium, The Federal Republic of Germany and The Netherlands, the U.S. Government delegation prepared a comprehensive discussion of the regulation of pesticides in the United States. This document was prepared cooperatively by the Department of Health, Education, and Welfare-Food and Drug Administration and the Department of Agriculture. An outline of the procedures to be followed in the regulation of pesticides is presented. In addition, the detailed residue analytical data on approximately 45,000 samples of raw agricultural commodities confirm the safety of our food supply.

Codex Committee on Residues. The Departments of Agriculture and Health, Education, and Welfare represent the United States on the Codex Committee on Pesticide Residues of the Codex Alimentarius Commission. The third annual meeting of the Committee was held in Arnhem, Holland, in October. Progress was achieved in the furtherance of international pesticide residue tolerances.

Received by the
Director of the
Bureau of the
Census

Washington, D. C.

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E X A M P L E S O F C H A N G E S
I N T H E P R O G R A M

The pesticide and pesticide related activities of the Department of Agriculture undergo constant review. These activities are never static but are continually adjusted to take advantage of new discoveries and to shift resources to where they can be best utilized. The fluid state of the activities can be illustrated by the following examples of lines of work initiated and terminated during 1968.

General

Initiated

Insecticidal mycotoxins from Aspergillus flavus. (E-fg) Connecticut (New Haven) Agr. Exp. Sta.

Mass rearing of Maris cornuarietis for biological control of aquatic weeds in temperate waters. (E) Coral Gables, Florida.

The use of chemicals for weed control and defoliation of crop plants. (E-fg) Georgia Agr. Exp. Sta.

The biology and control of economic wireworm species of Idaho. (E-fg) Idaho Agr. Exp. Sta.

Simple, rapid methods and equipment for detecting pesticide residues. (E) Midwest Research Institute, Kansas City, Mo.

Movement of chlorinated hydrocarbon insecticides in the vapor phase in soil. (I) Riverside, California.

Terminated

Weed control in pastures and turf. (I) Beltsville, Maryland.

Physiological responses of woody plants to herbicides. (I) College Station, Texas.

Chemical nature of allelopathic factors from weeds and their effects on crops. (E) Columbus, Ohio.

The effects of host-pesticide interrelationships on disease control. (E-fg) Minnesota Agr. Exp. Sta.

The biochemical basis of host-plant selection, feeding and nutrition in lygus bugs and aphids. (E-fg) New Mexico Agr. Exp. Sta.

Animals

Initiated

Influence of pesticides on lipid metabolism in adipose tissue. (E-fg) Connecticut (Storrs) Agr. Exp. Sta.

Biology and control of lice, mites, ticks and fleas of livestock and poultry in Western United States. (I) Fresno, Calif.

Metabolic fate and enzymatic reactions involved in the metabolism of carbamate pesticides in poultry. (I) Fargo, North Dakota.

The effect of various larvicides to control parasitism in cattle. (I) Experiment, Georgia.

Biological methods of control of animal parasites. (E-fg) Hawaii Agr. Exp. Sta.

Terminated

The effectiveness of swine management systems, housing and waste disposal methods for the control of fly and other insect propagation without insecticides. (I) Beltsville, Maryland.

Pesticide residues ingested by finishing and reproducing beef cattle. (E) Front Royal, Virginia.

Predaceous mites to reduce fly production in poultry droppings. (E)
University of California.

Biology and ecology of the lesser mealworm, Alphitobius diaperinus, in
poultry houses. (E) University of Maryland, College Park, Md.

Agricultural chemical residues in plant and animal products. (E-fg)
South Carolina Agr. Exp. Sta.

Biology, ecology, and control of fly parasites of livestock. (E-fg)
Kentucky Agr. Exp. Sta.

Field Crops

Initiated

The basis of resistance to organo-chlorine compounds in insects of cotton.
(E-fg) Alabama Agr. Exp. Sta.

Determination of chemical resistance of corn to European corn borer to
facilitate development of resistant types of corn. (E) Iowa State
University.

Inheritance of curly top resistance in vegetable crops. (E-fg) Idaho
Agr. Exp. Sta.

The hairiness character and the role it plays in cereal leaf beetle
resistance. (E) Michigan Agricultural Experiment Station.

Biology and ecology of soybean insects and methods for their control.
(I) Stoneville, Miss.

Isolation and characterization of insect pheromones of the cigarette
beetle, Lasioderma serricorne. (E) University of Wis., Madison, Wis.

Terminated

Biochemical nature of resistance in maize to attack by the European corn
borer. (E) Iowa State University.

Identification and control of pathogens of forage grasses and legumes in
the Gulf Coast area. (I) Stoneville, Miss.

Research on weed control in sugarbeets. (I) St. Paul, Minnesota.

Effect of environment and nutrition on the development of rice diseases. (I) Stuttgart, Arkansas; and Biggs, California.

Studies of absorption and translocation of herbicides in cotton and other crops. (I) Raleigh, North Carolina.

Effects of radiant energy on tobacco hornworm and budworm moths. (E) Virginia Polytechnic Institute.

Production of flue-cured tobacco as influenced by pesticides. (E-fg) Florida Agr. Exp. Sta.

A comparative study of the role of secondary plant substances in crops and other plants in determining the incidence and intensity of insect attack. (E-fg) New York (Cornell) Agr. Exp. Sta.

Horticultural Crops

Initiated

Biology, ecology and methods of detection of the imported fire ant in Florida. (E) University of Florida.

Biology and control of orchard infesting eriophyid mites. (E) Georgia Agr. Exp. Sta.

Biology, ecology and control of the Caribbean fruit fly. (I) Miami, Fla.

A study of population management of insects and mites attacking apples. (E-fg) North Carolina Agr. Exp. Sta.

Terminated

Vectors of peach viruses in the Southeast. (I) Ft. Valley, Ga.

Effects of photoperiod and light on development of the codling moth. (E) Washington State University.

Biology, ecology and control of fruit insect pests. (E-fg) Minnesota Agr. Exp. Sta.

Biology and control of insect pests of cherry. (E-fg) Pennsylvania Agr. Exp. Sta.

Ecology of mites within pomaceous tree fruit orchards. (E) Brigham Young University

Biology and behavior of the pear psylla in Central Washington. (E) Washington Agr. Exp. Sta.

Forests

Initiated

Population studies of the southern pine beetle in southwest Mississippi. (I) Alexandria, Louisiana.

Population dynamics of dwarf mistletoe on white fir. (I) Berkeley, Calif.

Effectiveness of a silvicultural control method for the red oak borer when applied to a large area. (I) Delaware, Ohio.

A study of heritable insect resistance in jack pine. (I) Rhinelander, Wisconsin.

Winter-spring variation in toxicity of herbicides to ponderosa pine and associated brush species. (I) Roseburg, Oregon.

Large-scale detection survey for introduced Formosan subterranean termite. (I) and (E) Southern, Western and Eastern States.

Plantation control of Scleroderris canker by sanitation cleaning. (I) St. Paul, Minn.

Diseases of forest and shade trees. (E-fg) New Hampshire Agr. Exp. Sta.

Population dynamics of sawflies associated with coniferous plantations. (E-fg) Wisconsin Agr. Exp. Sta.

Terminated

Chemical control of dwarf mistletoe in pines and true firs. (I) Berkeley, Calif.

Uptake, translocation, and cycling of residual pesticide by woody plants. (E) University of Georgia, Athens, Georgia.

Insect parasites and predators of the Engelmann spruce beetle. (I)
Ft. Collins, Colorado.

Pathology of the wilt disease of trees in the Northeast. (E-fg)
Maine Agr. Exp. Sta.

A P P E N D I X

Table 1. PARTICIPATING USDA SERVICES AND AGENCIES
Pesticides and Related Activities

Organizational Unit	Activity						
	R e s e a r c h	S u r v e y s	E d u c a t i o n	I n f o r m a t i o n	R e g u l a t i o n	C o n t r o l	M o n i t o r i n g
Agricultural Research Service							
Agricultural Engineering Research	X						
Animal Disease and Parasite Research	X						
Animal Husbandry Research	X						
Animal Health						X	
Crops Research	X						
Entomology Research	X						
Human Nutrition Research	X						
Information				X			
Market Quality Research	X						
Northern Utilization Research and Development	X						
Pesticides Regulation					X		
Plant Pest Control						X	X
Plant Quarantine						X	
Soil and Water Conservation Research	X						
Agricultural Stabilization and Conservation Service							
Policy and Program Appraisal	X						
Farmer Programs						X	
Cooperative State Research Service	X						
Forest Service							
Forest Pest Control						X	
Forest Protection Research	X						
Information and Education			X	X			
Timber Management Research	X						
Watershed, Recreation & Range Res.	X						
Federal Extension Service			X				
Economic Research Service	X						
Consumer and Marketing Service							
Livestock Slaughter Inspection							X
Processed Meat Inspection							X
Technical Services							
National Agricultural Library			X				
Office of Information				X			
Office of the General Counsel					X		
Research Program Development and Evaluation Staff	X						

Table 2 (Part A). FUNDS AVAILABLE FOR PESTICIDE AND RELATED ACTIVITIES
 United States Department of Agriculture
 Totals by Agency for Fiscal Years 1968, 1969, and 1970 Estimated
 (Thousands of Dollars)

Agency	1968			1969			Estimated		
	Program	Facilities	Total	Program	Facilities	Total	1969	1970	Total
Agricultural Research Service	82,698	3,100	85,798*	84,903	--	84,903*	85,422		
Agricultural Stabilization and Conservation Service 1/									
Cooperative State Research Service	9,509	--	9,509	8,522	--	8,522	8,522		
Consumer and Marketing Service	8,977	1,191	10,168	9,200	700	9,900	9,300		
Economic Research Service	420	--	420	580	--	580	635		
Federal Extension Service	512	--	512	517	--	517	517		
Forest Service	4,400	--	4,400	4,400	--	4,400	4,400		
National Agricultural Library	20,309	639	20,948	19,075	759	19,834	20,877		
Office of Information	295	--	295	295	--	295	295		
Research Program Development and Evaluation Staff	58	--	58*	76	--	76*	58		
	15*	--	15*	--	--	--	--		
TOTAL	127,193	4,930	132,123	127,568	1,459	129,027	130,026		

* Includes resources drawn from a \$225,000 intra- and interdepartmental pesticide coordination fund first appropriated to the Department in Fiscal Year 1965.

1/ Includes funds for Agriculture Conservation Program cost-sharing for weed and brush control not included in previous reports.

Table 2 (Part B) FUNDS AVAILABLE FOR PESTICIDE AND RELATED ACTIVITIES

United States Department of Agriculture
 Totals by Target for Fiscal Years 1968, 1969, and 1970 Estimated
 (Exclusive of New Facilities)
 (Thousands of Dollars)

TARGETS	1968	1969	1970 Estimated
1. Fundamental Biology	17,424	18,064	18,044
2. Improved Means of Nonpesticidal Control	21,555	22,222	22,364
3. Improved Pesticide Use Patterns	11,427	11,757	11,781
4. Toxicology, Pathology, Metabolism & Fate	5,588	5,760	5,764
5. Economics of Pest Control, Use, Supply, and Requirements	651	639	642
6. Pest Control ^{1/}	61,063	59,249	60,829
7. Monitoring	1,072	1,250	1,305
8. Regulation	3,645	3,856	4,156
9. Information, Education & Coordination	4,768	4,771	4,753
TOTAL	127,193	127,568	129,638

^{1/} Includes funds for Agriculture Conservation Program cost-sharing for weed and brush control not included in previous reports.

Table 2 (Cont'd.)
 (Part B)

Table 2 (Part C). FUNDS AVAILABLE FOR PESTICIDE AND RELATED FACILITIES
 United States Department of Agriculture
 Totals by Agency for Fiscal Years 1968 and 1969
 (Thousands of dollars)

Agency and Facility	Fiscal Year 1968	Fiscal Year 1969
<u>Agricultural Research Service:</u>		
Facilities for control of plant diseases, nematodes and insects, Beltsville, Maryland (Total cost - \$2,838,000 including \$338,000 planning funds provided in F.Y. 1965)		
Grassland Restoration Laboratory, Temple, Texas (approximately 80% of laboratory relates to pesticides research) (\$150,000 planning funds provided in 1968)	\$2,838	--
Additional facilities for horticultural research on ornamentals at Corvallis, Oregon, and Puyallup, Washington (approximately 80% of laboratory relates to pesticides research) (\$25,000 planning funds provided in 1968)	120	--
Modernization of tobacco research laboratory, Oxford, North Carolina (Total cost \$150,000) approximately 80% relates to pesticides research)	20	--
Enlarging Soil and Water Research Station, Orono, Maine (approximately 5% of laboratory relates to pesticides research) (\$45,000 planning funds provided in 1968)	120	--
	2	--
TOTAL, ARS Research Facilities	3,100	--

Agency and Facility	Fiscal Year 1968	Fiscal Year 1969
<u>Cooperative State Research Service</u>		
Grants to State Agricultural Experiment Stations	\$1,191	700
TOTAL, Cooperative State Research Facilities	1,191	700
<u>Forest Service</u>		
(Research)		
Athens, Georgia, construction, Forestry Science Laboratory	265*	95*
Delaware, Ohio, design and specifications, Insect and Disease Laboratory	39	573
Olympia, Washington, construction, Silviculture and Animal Problems Laboratory	65*	--
Durham, New Hampshire, design and specifications, Forestry Science Laboratory	10*	15*
Hamden, Connecticut, construction, Forest Insect and Disease Laboratory	210	--
Moscow, Idaho, design and specifications, Forestry Science Laboratory	40	5
Subtotal, Forest Research Facilities	629	688
(Action)		
Asheville, North Carolina, greenhouse	10	71
Alexandria, Louisiana, office and laboratory space	10	71
Subtotal, Forest Pest Control Facilities		
TOTAL, Forest Service Facilities	\$639	\$759

* Portion of total cost applicable to pesticide-related research

Table 3. CODE SCHEME

-- COMMODITY/IES OR RESOURCE/S --

Code No.	Subject	Code No.	Subject
1.	<u>General</u>	35.	Fibers
2.	<u>Animals</u>	351.	Cotton
		352.	Others
21.	General	36.	Tobacco
22.	Beef		
23.	Dairy	37.	Sugar
24.	Poultry	371.	Sugarcane
25.	Swine	372.	Sugar beets
26.	Sheep	373.	Others
27.	Horses		
28.	Others	38.	Other
3.	<u>Field Crops</u>	4.	<u>Horticultural Crops</u>
31.	General	41.	General
32.	Cereals	42.	Vegetables
321.	Wheat	421.	Potatoes
322.	Barley	422.	Tomatoes
323.	Oats	423.	Onions
324.	Rice	424.	Beans
325.	Rye	425.	Peas
326.	Corn	426.	Root Vegetables
327.	Sorghum	427.	Leafy Vegetables
328.	Others	428.	Curcubits
		429.	Others
33.	Forage		
331.	Grasses	43.	Deciduous Fruits
332.	Alfalfa	431.	Peaches
333.	Clover	432.	Plums
334.	Range	433.	Apples
335.	Turf	434.	Apricots
336.	Others	435.	Pears
		436.	Cherries
34.	Oilseeds	437.	Others
341.	Soybeans		
342.	Flax	44.	Citrus Fruits
343.	Safflower	441.	Oranges
344.	Peanuts	442.	Grapefruit
345.	Cottonseed	443.	Lemons
346.	Others	444.	Others

Table 3. (Cont'd)

Code No.	Subject	Code No.	Subject
<u>Horticultural Crops</u> (Cont'd)			
45	Small Fruits	47.	Nuts
451.	Grapes	471.	Pecans
452.	Berries	472.	Walnuts
453.	Others	473.	Almonds
		474.	Filberts
		475.	Others
46.	Ornamentals		
461.	Flowers		
462.	Shrubs	48.	Others
463.	Trees		
464.	Others		
		5.	<u>Forests</u>

-- PESTS --

Code	Subject
A.	<u>General</u>
B.	<u>Diseases</u>
C.	<u>Insects</u>
D.	<u>Weeds</u>
E.	<u>Parasites</u>
F.	<u>Nematodes</u>
G.	<u>Others</u>





Use Pesticides Safely
FOLLOW THE LABEL

U.S. DEPARTMENT OF AGRICULTURE